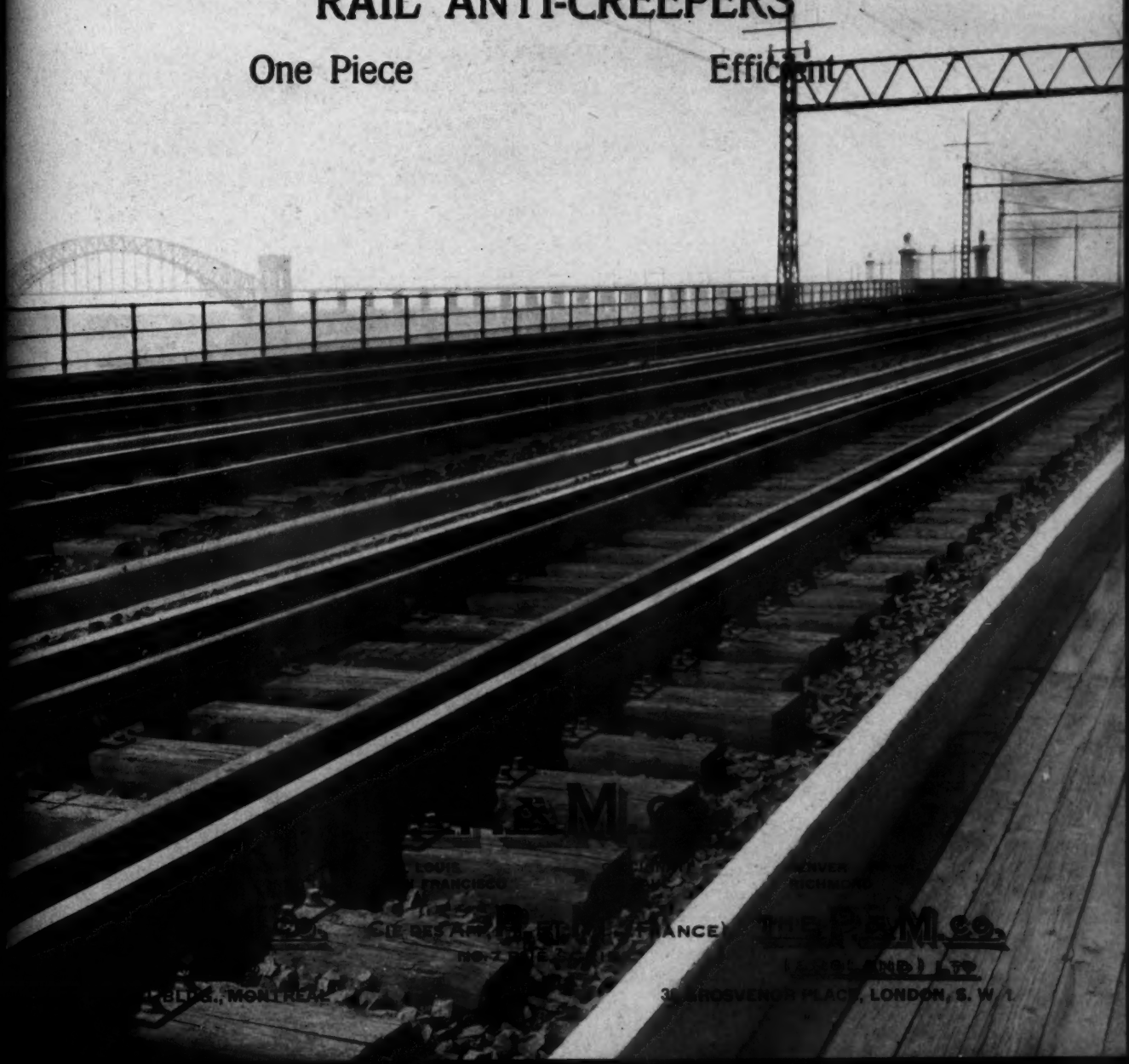
SEPTEMBER, 1923

Railway Engineering and Maintenance

YARDLEY
RAIL ANTI-CREEPERS
One Piece
Efficient



"Just as good as when I put 'er on a year ago"

Yes, and "she" will be just as good after another decade of service, too, if allowed to remain on the job. It's that **extra margin of staying power** in Hy-Cromes that does the trick.

The Reliance Mfg. Co.
Massillon, Ohio

BRANCH OFFICES: New York, Cleveland, Detroit, Chicago, St. Louis, San Francisco.

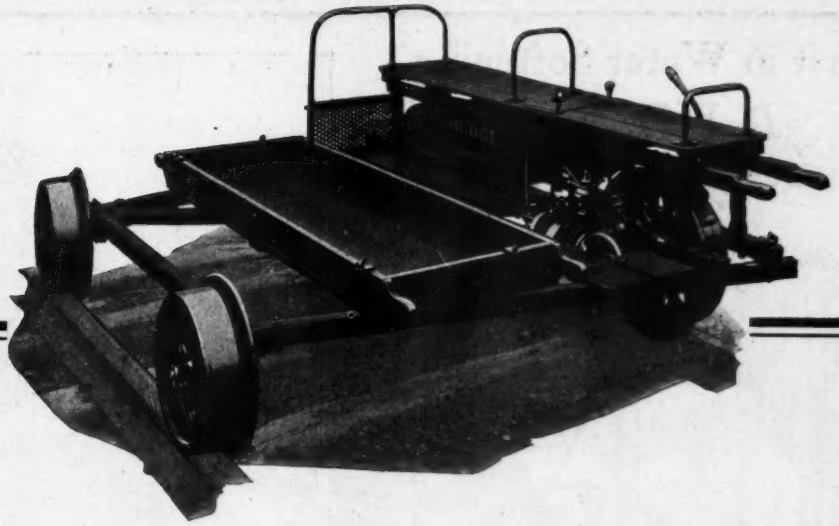
DISTRIBUTORS: Crerar Adams Co., Chicago; Bostwick-Braun Co., Toledo; W. and A. C. Semple, Louisville, Ky.; Keith, Simmons Co., Nashville, Tenn.; The Shapleigh Hardware Co., St. Louis. AGENTS: Walker Draft Gear Co., New York; K. C. Banks Co., Los Angeles; F. W. Cooper Engineering Materials, Ltd., Montreal, Canada.

RELIANCE HY-CROMES
Keep Tight Joints TIGHT

RELIANCE HY-CROME NUT LOCKS

RAILWAY ENGINEERING AND MAINTENANCE
Entered as second-class matter June 23, 1916, at the post office at Chicago, Ill., under the Act of March 3, 1879. Published Monthly by Simmons-Boardman Publishing Company at 608 S. Dearborn St., Chicago. Subscription price, United States, Canada and Mexico, $2.00 a year; foreign countries, $3.00 a year.

Alphabetical Index to Advertisements, Page 36 Classified Index to Advertisers, Pages 34 and 36



The *Improved* Mudge "Special"

Class E-11

Inspection Motor Car

Longer wheel base
Easier riding and handling
Improved frame construction
Larger and roomier tool tray
Improved controls
Safely Rails Standard equipment

The Mudge "Special" has been a leader in its field for twelve years. There are thousands in use. The improvements in this model of the "Special" are logical developments based on our experience with preceding models.

It is the ideal car for one man to handle.

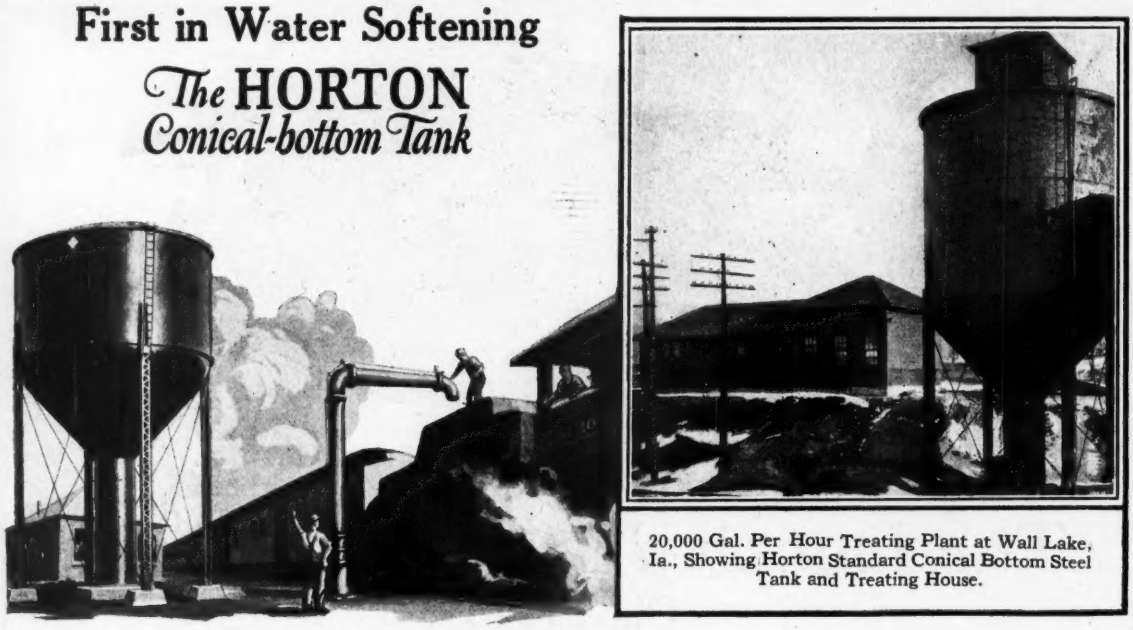
Safe—Reliable—Economical and Always Ready.

Mudge & Company

Manufacturers—Railroad Equipment
Railway Exchange Bldg. • CHICAGO

First in Water Softening

The HORTON
Conical-bottom Tank



20,000 Gal. Per Hour Treating Plant at Wall Lake, Ia., Showing Horton Standard Conical Bottom Steel Tank and Treating House.

$400 a Year Saved in Sludge Removal Alone

Actual use of Conical-bottom tanks on the Illinois Central shows that only 1,200 to 1,500 gallons of water per tank are required daily to wash out all sludge. To do the same work in a flat-bottom tank requires 8,000 to 10,000 gallons of water. Each Conical-bottom tank saves 7,500 gallons per day. Figuring water worth 15 cents a thousand gallons, each tank saves over $400 a year. Furthermore, the sludge for all practical purposes is *completely* removed.

A test was made to determine the amount of water required to remove the sludge from a flat bottom tank 22 ft. in diameter after 12 hours' operation, during which time 120,000 gal. of water had been treated, the sludge amounting to approximately 520 lbs. About 5,000 gal. of water was wasted and while a great deal of the sludge was removed, the tank was not clean by any means and repeated opening and closing of the sludge valve brought quantities of sludge, the stream of water being clear with streaks of sludge through it. The tank was drained of all water and it was found that the openings in the sludge system collected the sludge for only a short distance around the openings and the sludge had accumulated to a depth of three feet all around the edge of the tank. There was also a great deal of sludge between the sludge lines. Examination of the tank proved conclusively that the removal of sludge in a flat bottom treating tank is very expensive in the use of water and in most cases is inefficient and incomplete so far as the complete removal of the sludge is concerned.

A similar test was made with a conical bottom treating tank 28 ft. in diameter. After 60 hours' operation, during which time 1,000,000 gal. of water had been treated, and the sludge deposit amounted to over 4,000 lb., it was found that 2,300 gal. of water was sufficient to remove the sludge completely. The practice on the Illinois Central is to wash the sludge out twice a day and the water required for this purpose rarely exceeds 1,200 or 1,500 gal. daily, while to do the same work in a flat bottom tank would require 8,000 or 10,000 gal., a conservative estimate of the amount of water saved daily being 7,500 gal. which, at the low rate of 15 cents per thousand gallons for pumping and treating, means an annual saving of over $400 per year or six per cent on an investment of over $6,500.

Economy is only one of the important points of superiority of the Horton Conical-bottom tank. The large diameter for a given capacity results in a slow rate of upflow which is highly advantageous. The shape of the tank is convenient to piping and placing of valves. Better foundation designs permit correct distribution of load. Each one of these advantages helps to place Horton Conical-bottom first in water softening.

Chicago Bridge and Iron Works

CHICAGO, 2452 Transportation Bldg.
DALLAS, 1646 Praetorian Bldg.
SAN FRANCISCO, 1007 Rialto Bldg.
NEW YORK, 3156 Hudson Terminal
ATLANTA, 1036 Healy Bldg.
MONTREAL, 1151 Bank of Toronto Bldg.

920

On the Santa Fe in Arizona

Railway Engineering and Maintenance

Formerly the Railway Maintenance Engineer

Vol. 19 September, 1923 Number 9

TABLE OF CONTENTS

Editorials 337
Letters to the Editor 339
New Books 340
Maintenance Men Can Help Handle the Peak Load Traffic 341
Co-operation and Planning Will Prevent Delays; J. B. Martin 341
Do Work at Critical Points First; P. J. McAndrews 342
Every Employee Owes It to His Road to Do His Best; J. W. Powers 343
Prompt Attention to Defects Will Save Many Delays; D. F. Stevens 344
A Seasonable Program Will Keep Work Out of the Way of Traffic; C. J. Lepperd 345
New Rock Island Water Station Saves $12,000 Annually 346
It Is Better to Lead Men Than to Drive Them; Walter S. Lacher 351
Tracks for the Chicago Union Station Supported on Concrete; Joshua D'Esposito 353
Getting Good Results With Stucco on Frame Buildings; A. C. Irwin 357
Derailed Tank Cars Catch Fire and Destroy Two Bridges 360
The Tie Plug—One of the Things That Count 361
Lowering Costs for Cleaning Ballast 362
Unusual Precautions Taken With Harding Funeral Train 364
What's the Answer? 365
New Devices 370
Association Activities 372
The Material Market 372
General News 373

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F. C. Koch, *Business Manager*

WOULD YOU LIKE TO KNOW

How Maintenance Men Can Help Handle the Peak Load Traffic?

How to Shut Out Undesirable Water from a Driven Well?

The Effect of Concrete Slabs Under Tracks on Cost of Track Maintenance?

What Are the Relative Merits of Different Methods of Cleaning Ballast?

Answers to these and other practical questions will be found elsewhere in this issue.

Elmer T. Howson, *Editor*
Walter S. Lacher, *Managing Editor*
Milburn Moore, *Associate Editor*
David A. Steel, *Associate Editor*
H. F. Lane, *Associate Editor (Washington, D. C.)*

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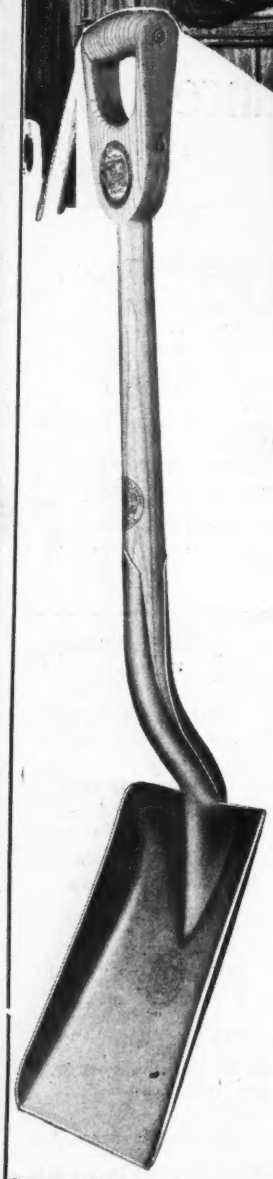


"We'll have to wait till someone manages to wear one out!"

THE City of Norfolk, Virginia, was doing some asphalt paving, and building a new concrete water-filtering plant.

With three well-known makes of shovels they got an average of but three weeks' use. Then they tried Wood's Mo-*lyb*-den-um Steel Shovels.

Four-months later our representative called to inquire how the shovels were doing. The reply was, "I am sorry that I cannot give you figures on a completed test, but we shall have to wait until someone manages to wear out a Mo-*lyb*-den-um Shovel."

This is only one of hundreds of similar tests on actual jobs. Invariably, no matter what the conditions or manner of usage, the Wood's Mo-*lyb*-den-um Steel Shovel lasts from two to six times longer than any other shovel made. And they are far lighter for a given strength. Naturally, the men, too, prefer them.

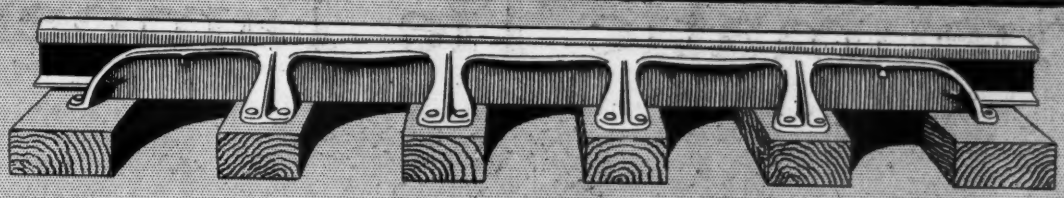
Write us for complete information about the application of Wood's Mo-*lyb*-den-um Steel Shovels to all your needs.

THE WOOD SHOVEL & TOOL COMPANY

Piqua, Ohio, U. S. A.

Wood's Mo-lyb-den-um Shovels

The American Super Steel



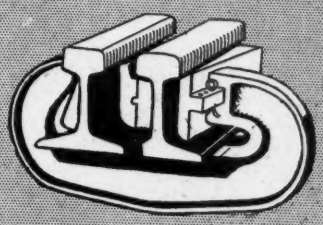
AJAX MANGANESE STEEL
ONE-PIECE GUARD RAIL

Ramapo and Ajax specialties have been long and favorably known under their individual names as manufactured by Ramapo Iron Works and Ajax Forge Company. These two companies are now consolidated into Ramapo Ajax Corporation, with five completely equipped works conveniently located for prompt deliveries to the railroads of the country. To assure service in the Western territory a stock of Ramapo Automatic Safety Switch Stands is carried at the Chicago headquarters.

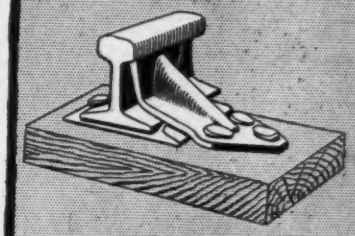
The Ramapo improved No. 20-B stand, placed on the market a year ago, has met with pronounced success. Repeat orders are coming in wherever it has been installed.

Other "RACOR" specialties not here illustrated include Switches, Frogs, Crossings, etc., Special Railway Track Work, Cast and Rolled Manganese Rail Construction, etc.

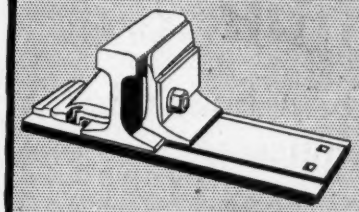
Particular attention is directed to the Ajax One-Piece Guard Rail at top of this page. Its combined simplicity and rigidity make this the most efficient and economical installation.



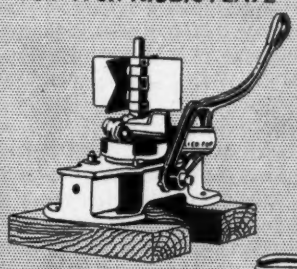
RACOR FORGED
HEAVY DUTY
GUARD RAIL CLAMP



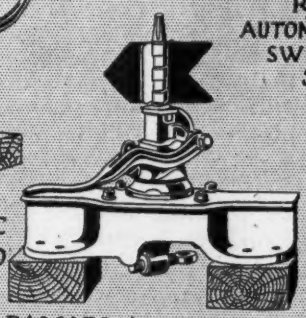
RACOR
FORGED RAIL BRACE



RACOR DOUBLE SHOULDER
SOLID BOTTOM
SWITCH RISER PLATE



RAMAPO AUTOMATIC
SAFETY SWITCH STAND
Style No. 20-B



RAMAPO AUTOMATIC
SAFETY SWITCH STAND
Style No. 19

RAMAPO
AUTOMATIC SAFETY
SWITCH STAND
Style No. 18

RAMAPO
AUTOMATIC SAFETY
SWITCH STAND
Style No. 17

RACOR

RAMAPO AJAX CORPORATION

RACOR

HILLBURN · NEW YORK

This Company is a consolidation of Ramapo Iron Works and Ajax Forge Co.

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CHICAGO

Mc Cormick Building
CHICAGO

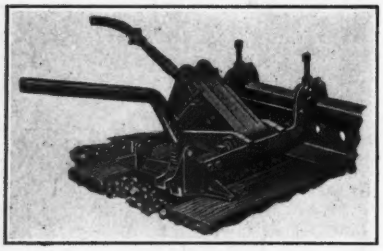
30 Church Street
NEW YORK

NIAGARA FALLS, N.Y.
SUPERIOR, WIS.

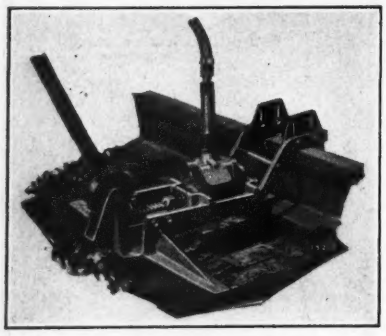
Canadian Ramapo Iron Works, Ltd., Niagara Falls, Ont.

Pneumatic Tie Tampers

A few of the other labor-saving air tools used with Pneumatic Tamping Outfits.



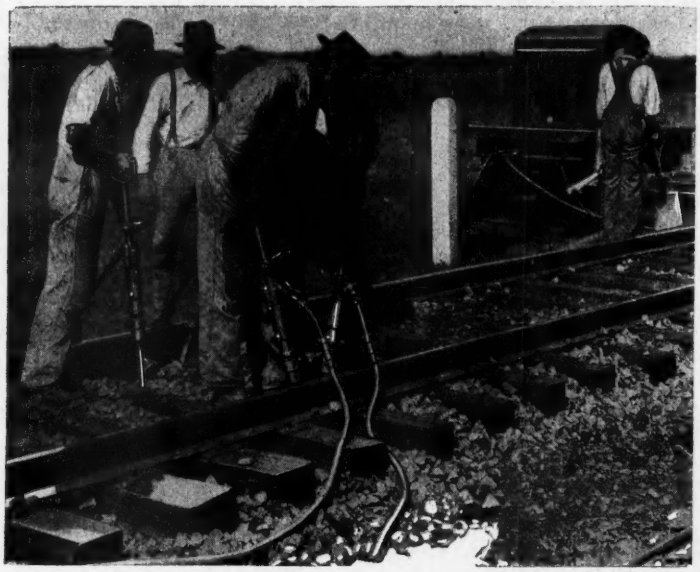
No. 9 Ingersoll-Rand Rail Drill. Puts a ⅞" hole through web in 25 sec.



Ingersoll-Rand Bonding Drill, No. 5. Averages 70-$\frac{7}{16}$" holes per hr.

No. 19 Ingersoll-Rand Rail Bolter. Bolts a 6 hole joint in 1 min.

Ingersoll-Rand Grinder. Saves labor on all grinding and cleaning.



A 4 Tool Pneumatic Tamping Gang. Air Compressor in Background.

Save Man-Power

Use air operated labor-saving machines

Ingersoll-Rand Pneumatic tie tampers enable small gangs to equal the work output of large hand gangs and to make a smoother, safer and more permanent roadbed. Four men with pneumatic tampers will do as much work as 12 to 16 men hand tamping.

The tie tamper compressor car is also a convenient portable power plant for operating other air driven tools for track and maintenance work. Such tools as rail-bonding and rail drills, rail bolting drills, grinders, spike drivers, riveting, chipping and calking hammers, rock drills, wire brush cleaners and sand blast and paint spray.

A pneumatic tamping outfit enables pronounced savings to be made on a wide variety of operations. Ask us for further details on the many uses.

INGERSOLL-RAND COMPANY, 11 Broadway, New York

Offices in all principal domestic and foreign cities

For Canada refer Canadian Ingersoll-Rand Co., Limited, 260 St. James St., Montreal

193TT

Ingersoll-Rand

International

Takes Big Step Ahead in the Tie Industry

THE International Organization has taken a big step forward by permanently marking its ties with I.C.C.Co. Dating Nails.

This dating nail, with the monogram and the year the tie leaves our plant, demonstrates our desire to have our name identified with International Ties during their entire life. It is our guarantee and your protection that every tie bearing this stamp of quality is sound and of full size and that the fundamental features of production which assure successful tie service have been conscientiously adhered to.

It is a simple matter to check up a tie's dimensions—but not so easy to sense that extra life insurance quality which comes from careful and scientific handling throughout production.

We know International Ties have that extra quality—that's why we place our dating nail in every tie—we also want to prove to you that the quality is there.

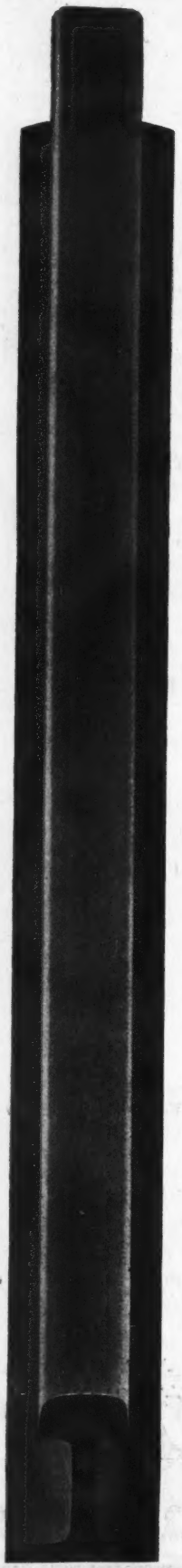
Prepare now for your 1924 requirements.—Avoid that wild, haphazard, "cut throat" buying so prevalent in the spring by contracting for your ties now with the International Organization.

Write for details

International Creosoting & Construction Co.

General Office—Galveston, Texas
Plants: Texarkana, Texas Beaumont, Texas
Galveston, Texas

International
Standard Specification Ties



YOU CAN IMPROVE YOUR ROADWAY BY USING STANDARD SECTION

TEE

RAILS

MADE FROM BASIC OPEN HEARTH STEEL, ROLLED FROM

RE-HEATED BLOOMS

and such accessories as

SPLICE BARS
BOLTS
TIE PLATES
SPIKES

produced by the

INLAND STEEL COMPANY

38 So. Dearborn Street, Chicago

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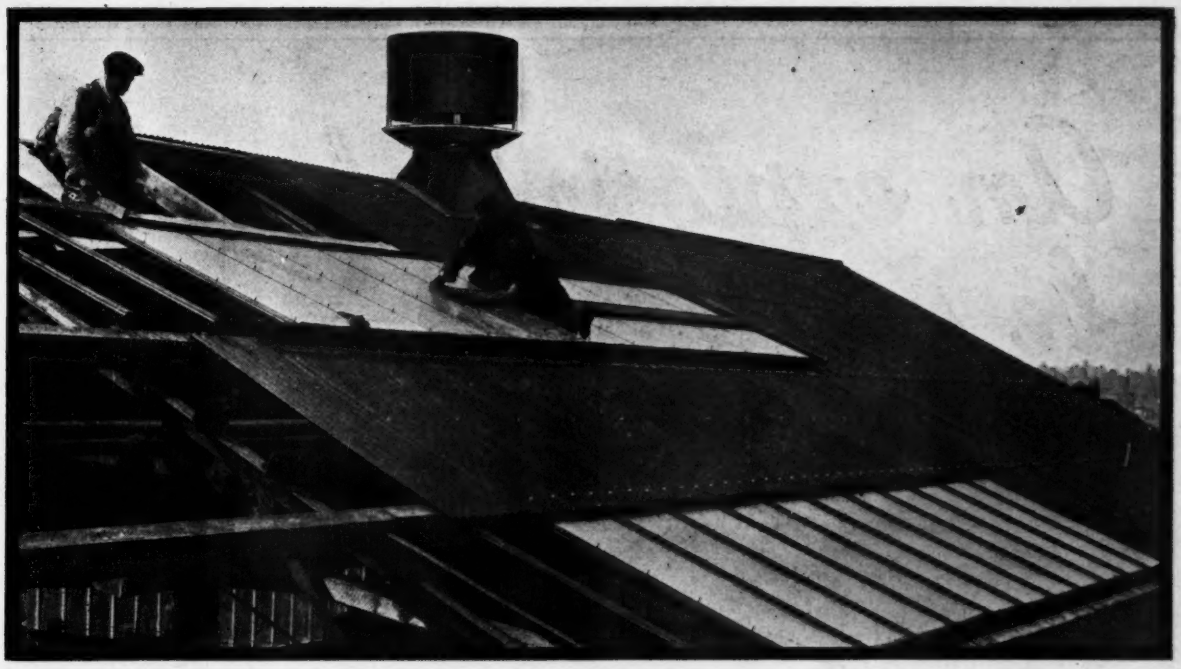

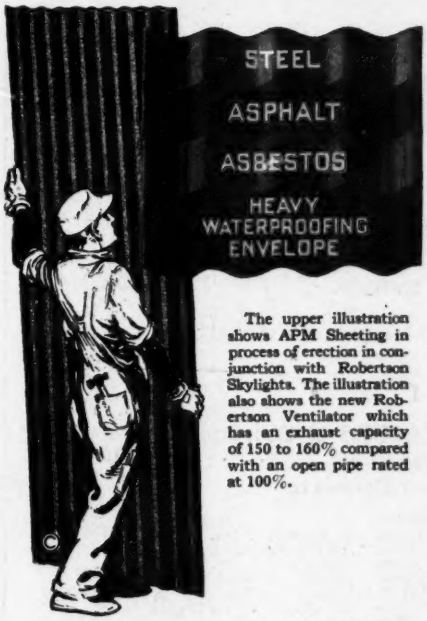

The upper illustration shows APM Sheeting in process of erection in conjunction with Robertson Skylights. The illustration also shows the new Robertson Ventilator which has an exhaust capacity of 150 to 160% compared with an open pipe rated at 100%.

A Long-Lived Roof and a Strong Roof Deck—All in One

As a roofing material for railroad buildings, Robertson Process Asbestos Protected Metal (APM) provides a remarkable combination of long life and low cost. It offers permanent construction at a price that materially reduces overhead charges. For APM is more than a roofing material—*it is a roof and a roof deck all in one.*

As you can see from the illustration at the left, APM is a steel roofing and siding sheet sealed in three impervious coatings, (1) Asphalt (2) Asbestos felt and (3) Waterproofing. You lay it right over the roof purlins, just as you would ordinary metal sheeting (see illustration above) but, unlike unprotected metal, APM is rust and corrosion-proof. It completely and permanently resists the destructive action of smoke, steam, fumes, gases—all the corrosive influences to which railroad buildings are constantly exposed. *It requires neither painting nor repairs.* It does away with maintenance expense and frequent replacement.

APM combines all the merits of corrugated metal sheets and high-grade built-up roofing without the disadvantages of either. Write for a sample of this enduring material and a copy of the Robertson Catalog which describes the uses and properties of APM in detail.

Prominent Users of APM

	First order	
Baltimore & Ohio	1909	6 orders
Boston & Maine	1913	8 orders
Chicago, Burlington & Quincy	1920	25 orders
Chicago & Northwestern	1908	11 orders
Chicago & Western Indiana	1916	4 orders
Denver & Rio Grande Western RR System	1914	8 orders
Erie	1917	8 orders
New York Central Lines	1913	18 orders
New York, New Haven & Hartford	1918	19 orders
Pennsylvania System	1909	115 orders
Southern Railway System	1915	17 orders
Southern Pacific	1916	9 orders
Union Pacific	1909	41 orders
American Car & Foundry Co.	1913	11 orders
American Locomotive Co.	1913	19 orders
American Railway Express Co.	1921	4 orders

H. H. ROBERTSON COMPANY, Pittsburgh, Pa.

Branches in all Principal Cities

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ROBERTSON PROCESS ASBESTOS PROTECTED METAL

APM

An explosive should be selected like a suit of clothes

THE explosives you use should fit *your* work.

Every quality should fit—strength, velocity, fumes, plasticity, water and temperature resisting powers, fragmentation obtained.

There is *one* explosive whose every quality makes it fit better than all others—and that one will save you money.

To provide it for you is the job of du Pont Explosives Service.

The du Pont Chemical Engineer—symbol of progress and leadership in the manufacture of products based on Chemistry.

E. I. DU PONT DE NEMOURS & CO., Inc.
Explosives Department
Wilmington - Delaware

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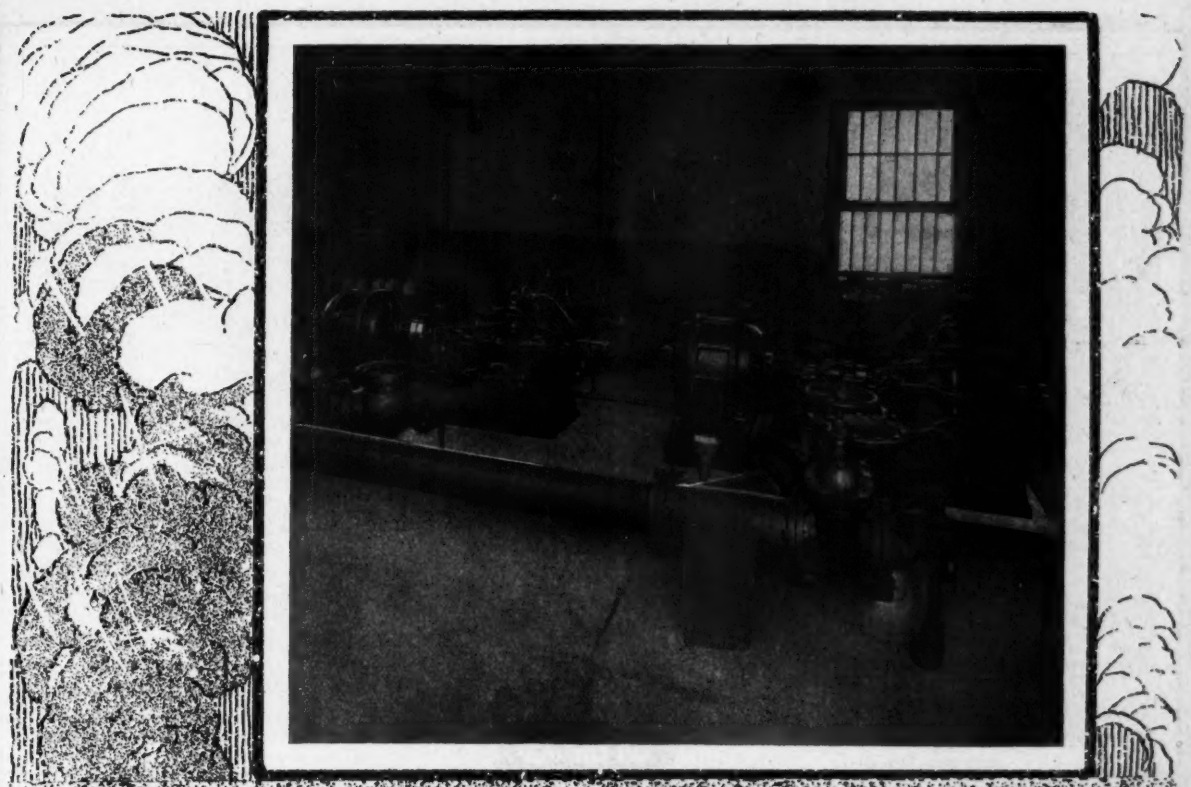
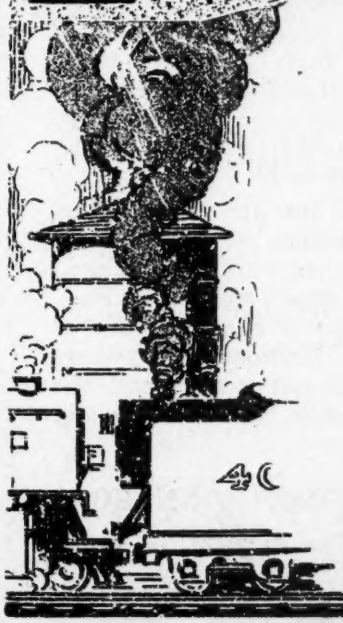
Du Pont Products Exhibit, Atlantic City, N. J.

EXPLOSIVES ~ SERVICE



AMERICAN

TRADE MARK REGISTERED U. S. PAT. OFFICE



$2400 a Year Saved in Pumpers' Wages Alone

This pumping station installation, made by The American Well Works at Kankakee, Illinois, for the Illinois Central Railroad, replaced a steam pumping plant that required the services of three attendants working in eight-hour shifts.

The American Well Works' installation being automatically controlled—only one man is required as attendant now—and the installation consequently has resulted in saving the Illinois Central Railroad $2400 a year in wages alone.

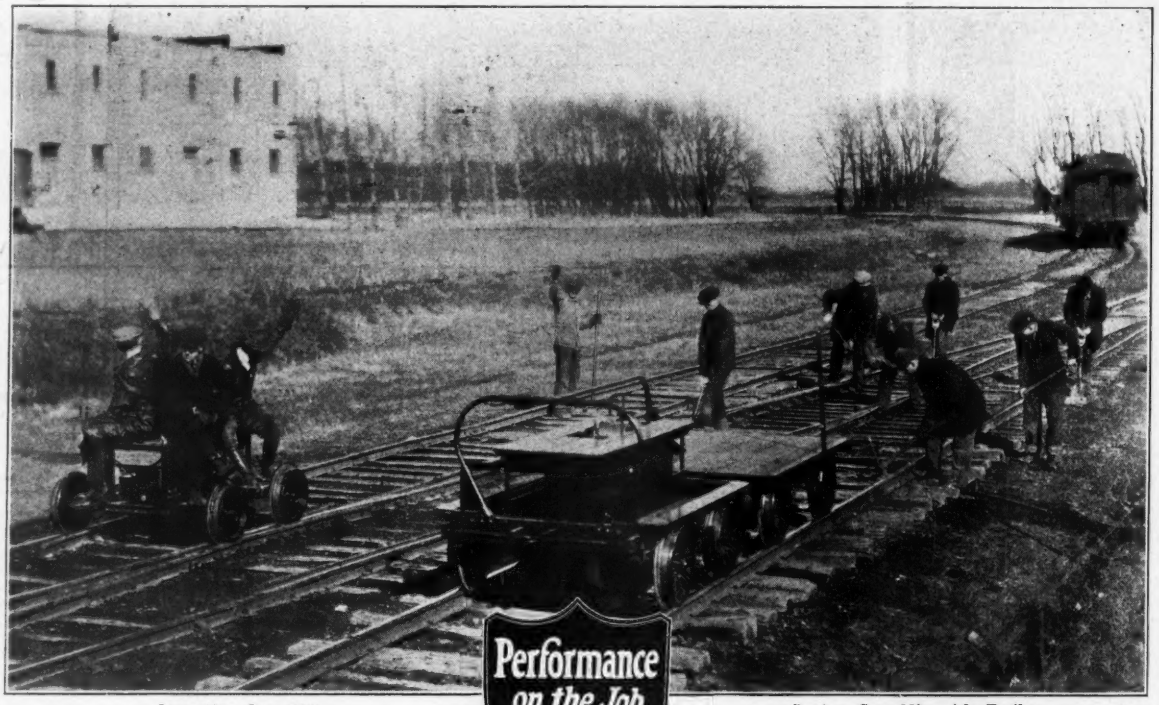
The water for the three locomotive supply tanks which this station supplies is pumped from the Kankakee River by two five-inch American Centrifugals direct connected to 25 H. P. 1800 R. P. M., G. E. Motors, automatically regulated by the Sundh control panel.

Data on the savings and cost per thousand gallons of water pumped, as well as figures on labor saved, will interest you. We'd like to send you comparative costs—ask us for them.

THE AMERICAN WELL WORKS

General Office and Works
AURORA, ILL.

Chicago Office
FIRST NATIONAL BANK BLDG.



Inspection Car—M19

Section Car—M2, with Trailer

Performance on the Job Counts

A Railroad Manager Says—

"The remarkable thing about this investigation (of railway motor cars) is not alone the conclusive proof of Fairmont's superior performance, but the equally conclusive evidence of Fairmont's popularity with the men.

"Every section foreman on our lines swears by the Fairmont and will fiercely defend it against all others. And the roadmasters share this feeling, with the added conviction that popular equipment begets increased economy of operation and stabilized labor.

"It doesn't stop there. The division officials, ever watchful of the morale of their forces, yet alert to enforce every known economy, find Fairmonts the logical recommendation—popular equipment for the men, low cost and efficient equipment for the road."

This quotation from an actual interview with a nationally prominent Railroad Manager, is not merely an isolated example of preference for Fairmont Railway Motor Cars, but is typical of the entire industry. Railroads everywhere who keep accurate cost records, and who value the opinions of their men, usually choose Fairmonts.

FAIRMONT RAILWAY MOTORS, INC., FAIRMONT, MINNESOTA

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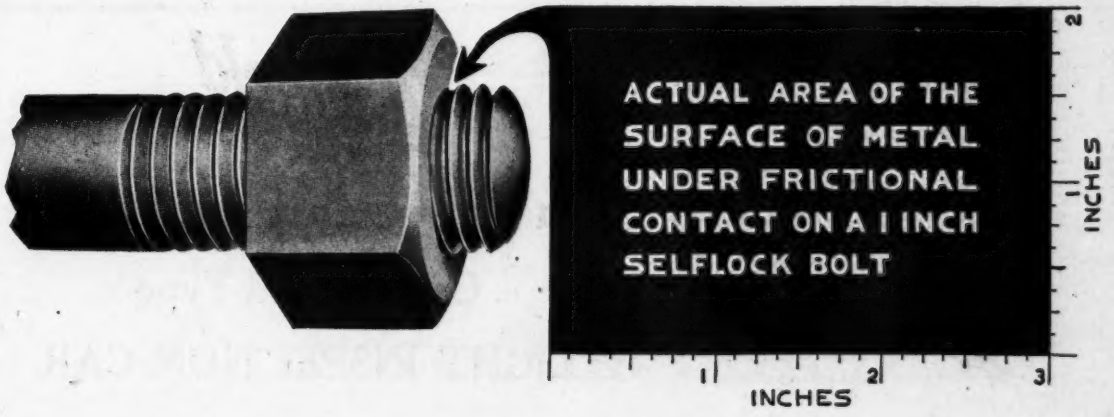

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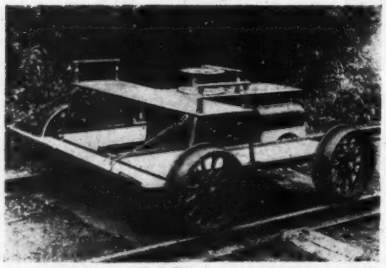

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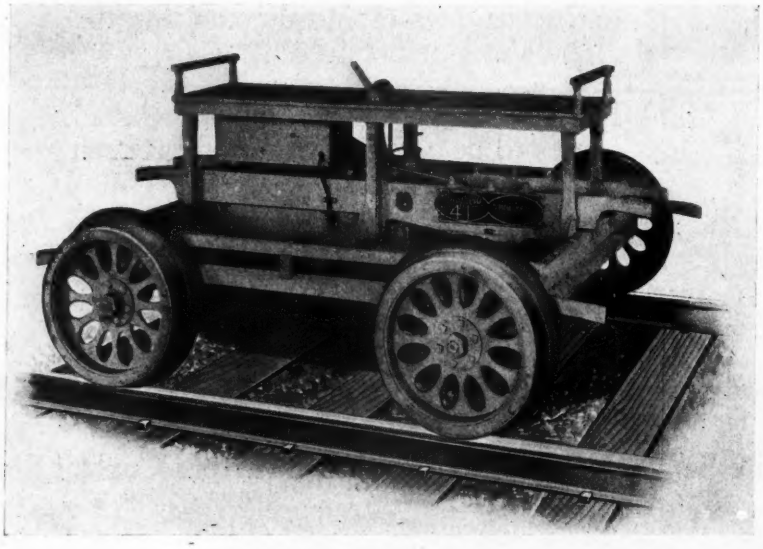

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Railway
Engineering and Maintenance

Volume 19 September, 1923 No. 9

CONSERVING FLOOD WATERS

THERE is one phase of conservation that is often overlooked in railway service, namely, the conservation of flood waters. It is true as a rule that where the floods are the greatest, there is also the most pressing need for the storage of their waters. These sections are often places where the streams are so few and the precipitation so irregular and so uncertain that the roads go long distances into the ground for their supplies. Furthermore, the quality of the water secured from the wells in these areas is usually such as requires its treatment, while the flood waters are unsurpassed from the standpoint of quality for use as locomotive water supplies, save possibly for the suspended matter which only requires a short period of time to settle out.

The importance of the conservation of flood waters increases with the quantity of water required. It is, of course, impossible in many instances to retain these waters, but the possibility of doing so should be studied carefully. Certainly no greater evidence of neglect in water service can be found than instances where bad water is pumped from low levels, while water of better quality is available on the surface.

PLAN TO ATTEND THE CONVENTION

THE CONVENTION season for maintenance of way officers is at hand. Those interested in the upkeep of track will gather at a meeting of the Roadmasters' Association at Chicago on September 18-20, while bridge, building and water service men will meet at Seattle, Wash., on October 16-18. With 40 and 32 years of continuous activity to their credit, respectively, these associations rank among the oldest railway organizations. They have done much to promote economical methods and their proceedings are an accurate index of the progress which has been made during these years.

These associations deserve the hearty co-operation and interest of maintenance men and of the managements because of the work which they are doing for the roads. One needs to attend only a single session to be convinced of the earnestness of purpose which characterizes the discussions and of the practical value of the information which is presented. A man can make no better investment of his time than to attend the convention in his field and to contribute of his experience to the discussion of the subjects under consideration. Likewise, the road with live maintenance men can well afford to encourage them to attend because of the enthusiasm and the initiative born of the enthusiasm which will be reflected directly in their work.

It is no mere coincidence that the paper to which first prize was awarded in the contest referred to on a following page was prepared by a vice-president of the Roadmasters' Association, while the recipient of the second prize is secretary and a past president of this organization. Both of these men have long been regular attendants at the conventions of this association and have participated actively in its work, and the broadening effect of this contact is reflected in their papers. Such is also the effect on other men. The convention will be held and the benefits are available to those who desire to avail themselves of them. To the man who makes the effort the results will be worth while.

BRANCH LINE MAINTENANCE

MORE THAN half of the mileage of some of the larger western roads is classified as branch lines. Even on what are commonly regarded as the roads of densest traffic some minor branch lines are to be found. The problem of determining what standards of maintenance are justified on these lines of light traffic is therefore common to almost all roads. Many of these branch lines handle a traffic so light that one or two trains in each direction are sufficient to accommodate it.

It is recognized that as a general business proposition the expenditures for the maintenance of such lines to main line standards is not justified. The problem is to determine the extent to which these expenditures should be curtailed. Obviously, regardless of business considerations, expenditures can not be restricted below the point where safety of operation is endangered. Above that level sound business principles dictate that only those expenditures be made which are warranted by the traffic.

The fixing of the limits for these expenditures involves a problem of railway economics which is worthy of the most careful consideration. On the one hand, the shipper or the passenger who uses the unproductive branch line has no right to expect that the patrons on other lines will contribute to the support of the line which is maintained for his service, and if his traffic and that of his neighbors is not sufficient to warrant liberal expenditures, he should be willing to assume the consequences. On the other hand, it may be good policy for a road to maintain its branch lines to a higher standard than is justified by the business on the branches itself because of the contribution which the traffic from these branches makes to the remainder of the system. Also the value of the good will of the communities served by these branch lines is not to be ignored, while on certain of the more prosperous roads the value of a fair degree of uniformity in service throughout the system leads to liberality in the maintenance of these more or less unproductive lines.

The prosperity of a road as a whole is promoted to the extent that local officers co-operate with the management in conserving the revenues of the road and spending them most wisely. It is the practice of some

superintendents, roadmasters and foremen to bring pressure upon their managements to give them all of the materials possible. It is the practice of other maintenance officers to make their requests on the basis of what they would do if these lines were their own property. The latter attitude is to be commended and to be encouraged, and for the maintenance officer to display it is for him to show real executive ability.

MAINTENANCE MEN ARE RAILWAY MEN

IT IS characteristic of large organizations that the men in a certain department frequently become so engrossed in the problems of their particular branch of the service that they lose sight of the relationship which their work bears to that of the organization as a whole and of the further fact that their activities must be correlated with those of other departments to produce the ultimate product which, with the railways, is transportation. From this standpoint the contest on Ways in Which the Maintenance of Way Department Can Assist in Handling the Peak Load Traffic has served a particularly valuable purpose. One cannot read the papers published on page 341 and succeeding pages without realizing the close relationship which the proper conduct of maintenance of way operations bears to the larger problem of moving traffic. Almost every operation performed by a maintenance gang affects the movement of trains in one way or another. Many of the suggestions made in these papers can be adopted at once and will facilitate the movement of traffic at this season when this result is so much to be desired. Other suggestions are applicable more directly to a season's program and require more time for their formulating and execution.

Aside from the relationship which maintenance activities bear to operation, the outstanding idea prevailing throughout these papers is that a carefully prepared program of work is the foundation of success—a program in which traffic conditions have been considered and each job is scheduled to be done when it will interfere least with and contribute most to the movement of trains. Such a program will also add to the efficiency with which the maintenance work is conducted, for it will avoid delays awaiting materials, will eliminate lost motion among the forces and, by avoiding periods of heaviest traffic, will reduce delays and loss of time to the maintenance of forces as well as to the train. In other words, the greatest success in the conduct of maintenance work is attained when this work is conducted with reference to its effect on operation as a whole.

WARREN GAMALIEL HARDING

Since our last issue a president of the United States passed to the Great Beyond. Called while the nation was expecting his early recovery from a collapse at Seattle, following a visit to Alaska to open the new Alaskan railway, the shock was doubly great. Never has a more impressive scene been witnessed than the tribute which countless thousands paid his memory during the passage of the train bearing the body of Warren Gamaliel Harding from the Golden Gate to the nation's capital, then back to his home at Marion, Ohio, where he was laid away among those he knew and loved in life. It fell to the lot of railway men to render the last service to their leader, and the same train which carried him west, alert and eager to meet the people and share with them the things that were close to his heart, bore him back through larger, but strangely quieter throngs.

Warren Gamaliel Harding was simple in habits, kindly in purpose and intent on service. Characteristic of the man is a statement said to have been made by him in a private conversation a few weeks before he died, "I intend to approach every problem with good will in my heart. I shall continue to be as I am, just Warren G. Harding as he is and as God fashioned him."

Let us hope with him in his own words, "When the light of life blows out there is a new radiance in eternity and somehow the glow of it relieves the darkness which is left behind. Never a death but somewhere a new life; never a sacrifice but somewhere an atonement; never a service but somewhere and somehow an achievement."

THE TRAINING OF A SECTION FOREMAN

THE SECTION gang is the unit around which the track maintenance organization is built. Its efficiency is dependent on the character of the foreman. As his duties are such that he can be given only limited supervision and he must work largely on his own initiative, the opportunities for loss in both time and materials are large. For this reason the recruiting of an efficient corps of section foremen is a primary requisite of economical maintenance.

In past years this was not difficult because the number of eligible candidates in the gangs was large. However, this condition has changed and in most areas a sufficient number of men of the requisite ability are no longer found in the gangs.

Means must therefore be developed to attract men of the required ability into track work, and then to give them the training necessary to fit them for the responsibilities of the position. The methods of obtaining this result are the subject of considerable difference of opinion. Track apprentices, assistant foremanships, school gangs, educational courses, and other expedients are being tried with varying degrees of success.

Because of the pressing nature of this question, we announce a contest on methods of training section foremen for which we solicit contributions, discussing the qualifications necessary for this position, methods of inducing men to compete for it, means of training men for the position, and the nature and extent of this training.

To stimulate interest in this discussion prizes of $25 and $15 will be paid for the two best papers received. The judges will base their award on the practical value of the ide s presented and the extent to which they may be applied in actual practice. All contributions should be sent to the Editor at 608 South Dearborn street, Chicago, and must be received by October 10.

CONCRETE TRACK FOUNDATIONS

THE CONCRETE slab as a foundation for standard railway track comprises the only fundamental improvement in track construction which has taken place in a long time. It ranks with the treated cross tie, the tie plate and the rail anchor, which, barring a general increase in the size and strength of the track structure and improvements in the design and quality of the materials used in the various units, comprise the only radical developments since track took its present form.

Except for the use of the bullhead rail in England, track has much the same form the world over. Steel

ties have been used to a limited extent in this country and in perhaps a greater mileage in Germany, but in spite of all efforts to the contrary there seems to be small prospect that the combination of rails resting on wooden cross ties which are imbedded in a loose, porous ballast will be replaced by anything radically different in other than special locations, such as tunnels, bridges, stations, etc. In view of this, the introduction of a solid, waterproof foundation on which to lay standard track construction comprises the most logical improvement, and while it would be folly to expect the immediate adoption of this development for any extensive mileage, it possesses merits, as pointed out by Mr. D'Esposito on page 353 of this issue, which should lead to its use in many situations.

WATCH THE CONCRETE STONE

THROUGH laboratory investigations we have learned what combinations of circumstances attending the making of concrete will produce the best results. With this information in the hands of the man who must do the work, it devolves upon him to reproduce these ideal conditions in the field in so far as the practical conditions imposed on him will permit. He can control the operation of the mixer and the time of mixing. He can see that the materials are proportioned correctly and can control the amount of water. He can protect the concrete from freezing in winter and from too rapid drying in summer. Within reasonable limits, he can rely on the cement, for although it is subject to considerable variation in quality, he can be reasonably sure that it will meet the minimum requirements of standard specifications. This leaves the aggregates, both fine and coarse, as the sources of the greatest danger from variations prejudicial to the quality of the finished product.

The stone in particular introduces a problem which is causing considerable trouble for the makers of concrete. Unfortunately the crushing of stone does not, in many cases, result in the production of particles sufficiently graduated in size to insure a good quality of concrete stone. Some stone breaks into a larger proportion of small pieces, others produce an excessive quantity of large ones. The result is that the stone must usually be screened into several sizes and then remixed in the proper proportions to produce satisfactory concrete aggregate. This remixing is difficult and the manner in which it is commonly done does not always produce the desired results. One method is to pour stone of two or more sizes into a car simultaneously. Another is to load the car with successive layers of the several sizes, but the net result is a considerable variation in the quality of stone as it is received on the job.

This is primarily the problem of the stone manufacturer. It is his business to devise methods by which the stone may be properly mixed. However, the chief obstacle to the securing of this result arises from the fact that the stone producer must necessarily have several outlets for his product, and unfortunately there is a decided lack of agreement among the users of stone, even for concrete purposes, as to what sizes constitute the most desirable material. As a result the producer must supply one kind of grading to one purchaser, and some other kind for another. There would seem to be considerable opportunity for intensive co-operation between the producers and users of stone for the purpose of developing a greater degree of standardization of product. In the meantime, the user must draw his requirements so as to produce the least hardship for the producer and then insist that these requirements are fulfilled and watch the material carefully as it is delivered to him.

Letters to the Editor

WATER INJECTION DESIRABLE FOR CONVERTED KEROSENE ENGINES

Belle Plaine, Iowa

To the Editor:

In the August issue of *Railway Engineering and Maintenance* one of the questions discussed in the "What's the Answer" department related to the practice of water injection for gas engines. It seems to be the general belief that the practice of injecting water into the cylinders of gasoline burning engines is of no benefit and tends to corrode and shorten the life of the igniter electrodes and valves.

When gasoline engines have been converted to operate on kerosene or distillate, however, water injection is often almost a necessity for two reasons. The principal reason is to prevent pre-ignition, as these engines are operated at a considerably higher temperature when run on the lower grade fuels. Also, water injection appears to minimize the pound in the cylinder and piston that is sometimes present in gasoline engines which have been converted to the use of kerosene. At least it seems to bring about a slower expansion of the gases so that the knock is not as noticeable or objectionable.

F. M. CASE,
Master Carpenter, Chicago & North Western

LONG AND SHORT GUARD RAILS

Las Vegas, Nevada

To the Editor:

A great deal has been said in *Railway Engineering and Maintenance* about guard rails. I refer particularly to the answers to a question on this subject published in the July issue. I find that an 8-ft. 3-in. guard rail is sufficiently long for any ordinary frog, if properly installed, except, when a spring rail frog comes on the outside of a curve on the main line. In this case, a length of 39 in. of guard rail is enough back of the frog point, but the guard rail should extend far enough ahead of the frog point to protect the movable part of the wing rail, as the wheels hug the outside rail of the curve and when they reach the movable wing rail of the frog there is nothing to hold the frog from opening but the springs. As a result the rail will open and cause the track to spread at that point, the action of the guard rail in pulling the wheels back in place then causing the cars to lunge.

If a guard rail is installed of sufficient length to protect the full length of the movable wing rail of a spring rail frog, the cars will not lunge when they pass through the guard rail. A guard rail 11 or 12-ft. long, properly installed, willl overcome this trouble.

JOHN THIESSEN,
Roadmaster, Union Pacific.

CONICAL BOTTOM TANKS FOR WATER TREATMENT

Huntington, W. Va.

To the Editor:

The article on the water treatment program of the Illinois Central by C. R. Knowles, which appeared on page 273 of the July issue of *Railway Engineering and Maintenance* is of interest as well as an inspiration to those handling railway water supply problems. The development of the conical bottom tank for use in connection with water treating plants is of special interest.

However, it is felt that there is some exaggeration in the statements relative to the savings in the amount of water required for sludging. My experience in connection with sludge removal in flat bottom tanks used in railway water softening indicates that a satisfactory removal may be obtained by using approximately six inches of water in each eight hour shift. This means a consumption per shift of 1500 gal. for tanks 24 ft. in diameter, which is considerably below the estimate advanced in the article. It is also very probable that the "low rate of 15 cents per 1000 gal.," used as the basis for determining the saving made is high. The cost for water used in sludge removal purposes can hardly be taken at the entire unit cost of the water supply as the additional expense incurred only involves additional power required for pumping the water and does not affect the overhead charges.

It is also difficult to see what the advantage is in leaving the bottom portion of the water treating tank a useless air space when at less cost the straight sides of the tank can be continued to a ground foundation and this space utilized for water storage and sedimentation purposes. However, there are undoubtedly possibilities in this new development, particularly with reference to sludge removal and the subject will be studied with considerable interest.

R. C. BARDWELL,
Superintendent Water Supply, Chesapeake & Ohio.

A GRADUATED WAGE SCALE

Ysleta, Tex.

TO THE EDITOR:

I have long advocated a graduated wage scale among section forces, based on length of service, efficiency, loyalty and a disposition to forge ahead. It is a well known fact that some section foremen are considerably more efficient than others, yet the foreman who is less efficient receives just as much money as a foreman in every way his superior in work. Again, there are laborers in almost every section crew who are efficient, willing workers and who are always put in the lead and picked out to do the particular and hurry-up jobs, yet they receive no extra wage for staying with the job and becoming more efficient. Is this right?

There is no incentive for the old timer to try to outdo his associates, so he plods along in the same old way. I think that it is better to pay these men what they are worth in comparison with other men doing the same class of work, rather than to advance wages in general, because it will tend to attract a better class of men and men that can be depended upon to stick.

In order to convey my idea more plainly, I suggest the following scale to apply to my own gang of eight men, working eight hours per day:

First man $2.75; second man $2.50; third man $2.35; fourth man $2.25; fifth man $2.15; sixth man $2; seventh man $1.90, and eighth man $1.75. This is only $1.65 in excess of a blanket rate of $2 per day for the same number of men working the same number of hours. In case of larger gangs, more $2 and $2.15 men could be used, as an order to increase force always brings out men of little or no experience. In smaller gangs, the foreman generally cuts down to good men who are apt to be worth the higher scale. The granting of an increase in a laborer's pay should be left to the foreman and roadmaster, as they are in closer touch with the men than the higher officers. The increase in a foreman's pay should be determined by the way his work towers above that of other section foremen. There is a difference in men and this should be met by a difference in pay.

Some may think that favoritism would be shown. It is hard to maintain a perfect system, either in the office or outside, but I believe that this can be worked out. One must agree that where men are placed on their own merit, working for advancement, there is less liability of strikes.

L. FLYNN,
Section Foreman, G. H. & S. A.

NEW BOOKS

Practical Railway Maintenance. By Charles Weiss, assistant supervisor, Pennsylvania System. 350 pages, 88 illustrations. 6 in. by 9 in. Bound in cloth. Published by the McGraw-Hill Book Company, New York City.

The title of this book is unfortunate, indicating as it does that all branches of maintenance work are covered, while in reality it treats only of track work to the exclusion of bridge, building and water service maintenance. With the limits so defined it presents a large amount of information of value. The author has drawn freely on his experience as an assistant supervisor on the Pennsylvania and the standards of that road are illustrated freely throughout its pages. The book is divided into three sections. Part one—Details of Track Work—consists of 80 pages in which the more general problems of track maintenance are treated, including gage, surface, superelevation and line. Part two—The Use and Care of Track Materials—consists of 96 pages with chapters on rail, ties, ballast and other elements of track construction, while the third portion contains 100 pages covering miscellaneous subjects, including the handling of men, work train operation, reports, records and correspondence, with brief reference to other branches of maintenance work with which the track man is brought in contact. An unusual feature of the book is the inclusion of 55 pages of tables. The book is well written although it is to be regretted that the author saw fit to dismiss as important a subject as drainage with eight pages and to make only casual reference to labor saving equipment.

Foundations, Abutments and Footings. By Geo. A. Hool and W. S. Kinne, professors of structural engineering, University of Wisconsin, Madison, Wis., editors-in-chief. 414 pages, 6 in. x 9 in. Bound in cloth. Published by the McGraw-Hill Book Company, 370 Seventh Avenue, New York.

This is the first of a series of six volumes designed to cover the entire field of the design and construction of the principal types of modern civil engineering structures, which series is being prepared by a large corps of contributing editors. It is difficult to understand why the word "abutments" is included in the title of this first book, since the term as ordinarily used implies something more comprehensive than foundation work and would seem to find better place in a later volume relating to the various types and classes of masonry structures. The treatment of bridge piers and abutments is too elementary and condensed for such a series. In general, the treatment in this volume is descriptive, treating in order, soil investigation, excavation, including machinery and equipment, foundation methods, etc. Considerable space is devoted to foundation excavation, both open and pneumatic, but the treatment gives the impression that the authors are primarily interested in building excavation rather than bridge work. The same comment applies to the chapter of underpinning, which relates entirely to buildings, to the exclusion of bridge sub-structures. Sections devoted to piles and pile driving contain a large amount of valuable information, but the impression is given that the authors are particularly favorable to the concrete pile, with a decided tendency to discredit the use of creosoted wooden piles for other than marine structures. Chapters on foundations required for special purposes contain information on machine foundations not ordinarily available in texts.

A Busy Terminal Where Delays Must Be Avoided

Maintenance Men Can Help Handle the Peak Load Traffic

Prize Articles Disclose Many Timely Suggestions for Meeting the Present Railway Problem

THIRTEEN papers were submitted in the contest on "Ways in Which the Maintenance Department Can Assist in Handling the Peak Load Traffic." These papers were submitted to a committee consisting of J. J. Pelley, general manager, Illinois Central; C. T. Dike, engineer maintenance of way, Chicago & North Western, and I. H. Schram, regional engineer, Erie, Chicago, who awarded first prize to the paper submitted by J. B. Martin, supervisor, New York Central Lines west, Elkhart, Ind., and second prize to P. J. McAndrews, roadmaster, Chicago & North Western, Sterling, Ill. Special mention was also given to papers submitted by J. W. Powers, supervisor of track, New York Central Lines east, Rochester, N. Y.; D. F. Stevens, general superintendent, Baltimore & Ohio, Cleveland, Ohio; C. J. Lepperd, supervisor, Philadelphia & Reading, Pottstown, Pa., and J. P. Corcoran, roadmaster, Chicago & Alton, Bloomington, Ill. The prize winning papers and others received in this contest follow:

First Prize—Cooperation and Planning Will Prevent Delays

By J. B. Martin

Supervisor, New York Central, Lines West, Elkhart, Ind.

Statistics show that the railroads are now handling the largest business in their history and it is evident that this traffic will increase during the fall and winter with the heavier grain and fuel movements. In order to meet these conditions and promote the public welfare the roads are making every effort to have the maximum of facilities and equipment available by September 1 to handle this increased volume of traffic.

The successful solution of this problem will require the best efforts of every railway man. The maintenance of way department has a vital responsibility in its proper solution as the maximum use of facilities and equipment cannot be secured unless delays to traffic are reduced to a minimum. This department is responsible for seeing that every facility is in condition for the heaviest requirements and that no equipment is diverted from revenue business unnecessarily. The successful solution of this problem will be found in co-operation, careful planning and management.

The maintenance of way department is to a large extent responsible for delays to traffic and equipment from the following causes:

Slow orders.

Work that requires the flagging or occasional stopping of trains.

Work trains that require equipment that is needed for the movement of revenue traffic and occupy tracks that are needed for other business.

Derailments due to track conditions or to which they may contribute.

Taking yard tracks out of service for heavy repairs and renewals.

Holding cars loaded with company material.

The elimination of these delays is largely a matter of careful and intelligent planning.

Before the beginning of the active season of maintenance work, a thorough study should be made of all work that is to be done and a program arranged so that the most important work will be completed before the period of heavy traffic arrives. Rail can be laid as soon as it is received and if it is necessary to use the forces for laying, the work of spacing ties and surfacing can be deferred until all of the rail is in the track so that it will not be necessary to use slow orders or delay traffic on this account later in the season when the traffic is at its height.

Where operations are carried on that require flagging, field telephones for keeping in close touch with train movements and motor cars for calling in and posting flagmen are indispensible, and foremen in charge of the

work should be instructed and coached in ways of getting the most use of the track without delaying traffic and accomplishing more work than by the old methods. When heavy trains are stopped or delayed there is a considerable slowing up of traffic. There is also the danger of pulling out draw bars, which not only delays the train itself but holds up the maintenance work as well and may result in disarranging the program at other points where it is planned to use the track at a particular time.

Work trains, owing to their high cost, should be reduced to the minimum at all times, particularly when traffic is heavy as only a small amount of work can be accomplished then and the cost is out of all proportion to the results. Care should be taken to see that no work is performed by work trains that can be handled as well or better by some other arrangement. Frequently this service can be performed by local trains without inconvenience. Certain materials can also be handled economically in terminals and for short distances with trucks or motor cars.

Work train service can be reduced by using modern labor saving equipment which also speeds up the work, such equipment including ditching machines, spreaders, automatic dump cars, rail loaders, self propelled locomotive cranes and steam derricks which do not require a locomotive to handle them and can often replace a work train, motor cars, etc.

The distribution of various materials requires considerable work train service. This can be reduced if care is taken to have all of the material for a particular job or location distributed at one time and without making several trips to that location. The operating department can assist materially in reducing work train service by seeing that these trains are not delayed unnecessarily.

Perhaps the most serious cause of congestion is terminal delays. There is scarcely a yard that is not taxed beyond its capacity and its maintenance becomes an important matter. All derailments should be analyzed carefully and their causes determined. Where the track is at fault or contributes in any way to the cause of the accident, steps should be taken to remedy the condition, either by the renewal of the defective material or by the adoption of new standards or better organization.

Maintenance work in yards and terminals requires careful study and planning. Before the active season starts there should be a thorough inspection and study of conditions, a program should be adopted for the season and arrangements made for the necessary forces and the delivery of materials so that the heavy repairs and renewals on important tracks and leads can be made when traffic conditions will permit taking them out of service and the work can be done in the most economical manner and with the least inconvenience. There should be a thorough understanding between the foremen and the supervisor regarding this program and methods of carrying it out and its progress should be checked at intervals. It is evident that circumstances beyond control and that can not be forseen will make it impossible to adhere to the program in all of its details, but if it is followed up, the main objectives will be accomplished. It is important to keep the yard masters acquainted with the program so that there will be complete co-operation with the operating department.

During the summer attention should be given to drainage in yards to reduce the danger of tracks and switches freezing up. Snow and ice are often the cause of serious delay in yards and at interlockers and to avoid this it is necessary to have forces organized and equipped that will be available on short notice.

Where extra gangs are employed during the winter it is advisable to locate them so they can be used at important points in case of storms, as men who are regularly employed and familiar with conditions are much more efficient than extra men who are picked up as the occasion requires. Much of the work equipment such as locomotive cranes, levelers, ballast plows and tamping machines will be found valuable in fighting snow and ice during the cold months.

Cars loaded with company material take up much equipment. This can be materially reduced if it is given the attention it deserves. Records of cars that have been loaded or are en route should be kept and checked daily to see that cars are placed promptly and unloaded on arrival at destination, and the equipment released for other service. It is important that cars should be sent where the material is needed to avoid reconsigning, extra switching and hauling.

As stated at the beginning of this article, the elimination of delays to traffic by the maintenance of way department result from intelligent planning and co-operation with other departments. If the subject is studied it will be seen that this department can and is playing an important part in handling the peak load.

Second Prize—Do Work at Critical Points First

By P. J. McAndrews
Roadmaster, Chicago & North Western, Sterling, Ill.

That maintenance men can aid materially in handling the peak load of traffic successfully and that they should and will do so goes without saying. To get the maximum efficiency, full co-operation between mechanical, operating and maintenance forces is essential and justifies close study by managing officers, under whose direction these several departments combine to make up the organization that produces transportation. Assuming a railroad property to be in reasonably good physical condition a carefully thought out and energetically followed plan of maintenance work should aid greatly in making the handling of the peak load of traffic in accordance with the plans of the American Railway Association certain of successful accomplishment.

Materials such as rails for relaying, fastenings, switches, etc., should be provided early enough to permit the rail renewal program to be finished before the heavy traffic moves. Heavy jobs of reballasting must also be completed early in the season to avoid slowing up traffic and also to release the considerable number of cars and engines required for handling the rail and ballast.

To get the materials in time calls for the full co-operation of the officers in charge of purchases. In the performance of the work the maintenance department must also have such assistance as the mechanical and operating staffs can give by furnishing good equipment and giving up a track in multiple track districts when this is feasible. It is agreed by most maintenance men that ordinary surfacing of main tracks, ordinary tie renewals and that class of work known as "running repairs" can be carried on with little or no loss of efficiency under even quite heavy traffic, but as there is some loss even in the performance of this ordinary repair work in the dense traffic districts near large railroad centers or terminals plans should be made to concentrate on such districts during the period of lightest train movement.

As the track structure is the foundation of a successful transportation system, so are the engine terminals, classification yards, water and fuel stations, interlocking plants, etc., the keys to successful operation. Tracks at

these facilities should be given preferred attention early enough in the season to avoid terminal delays during the period of heavy traffic or in severe winter weather. Switching leads in particular and all yard tracks in general should have necessary work done on them at the time that they may be spared from service most. It is only at such times that economical repair work may be done.

The use of work trains for the handling of track maintenance forces should be avoided at all times, thus allowing equipment and crews to be used for revenue traffic handling. With the types of motor cars and trailers now in use this can be done in most districts. To do the work early and get work trains off the line according to the program of the A. R. A. it is essential that a work train should handle more than one rail loader and more than one ditcher, that air dump cars be used and that every proven device that will expedite the work and reduce man power be utilized. In the repair and maintenance of bridges the same principles should be followed, and heavy work which may require work trains, or jobs of such a nature that a slowing up of traffic is necessary, should be completed as early in the season as conditions will permit.

On some roads the bridge and building department is charged with the work of maintaining coal hoisting machinery, and it is essential to smooth and expeditious train movement that such machinery be carefully looked after before the heavy traffic is offered, that repair parts may be provided and any needed replacements and adjustments of such equipment be done when the plants can be shut down temporarily without detriment.

An assured supply of coal must be provided. The water supply facilities must also be analyzed carefully and shortages guarded against by having pumps, motors, cranes and tank spouts in first class condition. Here again it is important that repair work be done before and not after the peak traffic is on the rails awaiting movement.

The above outline, when scanned by practical maintenance men, may appear ideal but impractical because recent experience makes it appear that rail mills will not roll the rail, that purchasing departments can not or at least do not buy the ties early enough or that tie producers will not get them out, and that if all of the roads subject to peak load traffic in the early fall should try to get all of their work done before September 1 the demand for track and other classes of maintenance labor would be abnormal and a shortage would exist such as appears to be the case at present. However, we wonder why the steel mills can not be induced to roll rail in winter to the exclusion of structural material that may not be so urgently needed, and why the railroads will not be permitted to so finance themselves that ties may be purchased a year in advance of the needs so that they may be delivered during the period when cars are plentiful and other traffic lighter, thus avoiding the use of cars at the time when they are needed for the transportation of grain and fuel. Much may be accomplished by the maintenance department under present conditions and with the facilities at hand, but a great increase in efficiency might be secured if the railroads were freed for a few years from the restrictive legislation that prevents the carrying out of progressive programs for their physical improvement and maintenance.

As every idle car, every delayed train, every accident and every delayed operation either by men or machinery is an economic loss to the transportation company, it is essential that work be so arranged that delays and accidents be kept to the minimum.

Every Employee Owes It to His Road to Do His Best

By J. W. Powers,
Supervisor of Track, New York Central, Lines East, Rochester, N. Y.

According to the third progress report prepared and made public by the Car Service division of the American Railway Association, the railroads hauled the largest traffic in the first six months of 1923 that was ever handled in any six months in the history of American railways. Record breaking traffic continues and with the large crops now being harvested it is to be expected that the amount of business during the summer and fall months will exceed that ever handled at this time in previous years by the railways of the United States, and that a new record will be established. With this prospect in view, the practical problem confronting the maintenance of way men is how best to assist the operating department in handling this enormous traffic.

On the efficiency which the railways of the United States will demonstrate in handling this record breaking tonnage will depend to a great extent the continued cooperation of the government and the public. Therefore, it behooves every loyal employee in every department to co-operate to the fullest extent of his ability in assisting his officers in meeting the demands upon them.

Because of the importance of the immediate problem with which the railways are confronted it is not only necessary for employees to perform to the full measure of their ability the duties required of them, but they should constantly seek new and better methods and make full use of time-tested principles and compare the methods employed by themselves with those of others who have solved problems similar to their own.

The railroads of this country need the loyal support and co-operation of every officer and employee during this time of proposed adverse railroad legislation. If each employee will study the situation and exert his influence by stirring up good loyal citizens everywhere, they will soon compel the politicians to keep their hands off and prevent them from inflicting all kinds of drastic, nonsensical and unreasonable legislation on the railroads.

The rules promulgated and enforced on most, if not all railways, requires co-operation between the officers of all departments. This should not be given grudgingly but to the full measure of their ability, especially during the present crisis.

A definite responsibility rests upon the officers of the maintenance of way department to co-operate with their transportation officers and aid them in every way possible in the movement of traffic, for while the movement of cars is an operating problem, the construction and maintenance of the tracks and structures over which the traffic moves is a maintenance problem. Therefore, this department is a vital factor in meeting the present and future demands and promoting efficiency in the successful operation of the railroads.

Supervisors of track should insist that all cars in which company material is shipped by their employees be loaded to their full capacity and that they should take steps to release as promptly as possible all cars assigned to them. The daily reports rendered by foremen on many roads show the number of cars received, loaded and unloaded or forwarded and the work train reports sent to the supervisor, division engineer and engineer of maintenance of way daily give the same detailed information. The supervisor is required to report to the division engineer the number of cars on hand, loaded with material and unloaded together with the dates on

which they were loaded or received under load, also the number of cars released. In this manner preferred attention is given to the prompt release of cars in order to secure the maximum service from them.

It frequently occurs that cars loaded with track material can be unloaded by placing them on sidings as close as possible to where the material is needed and transferring the material on to a large trailer with motor car by means of which it can be hauled to the place required. In many cases this method is not the most convenient or economical one but a work train engine which would otherwise be required for the purpose of unloading such cars can be used for hauling freight or other purposes. Some of the work requiring the use of a work train can be done as well with a light engine. Therefore, the operating department should be fully advised whenever this is possible so that the heavier power can be used where it is most needed. When unloading cars with work train it is possible on some occasions to unload several cars at a time. For example, the writer has used two steam cranes to load and unload rail and at the same time load and unload angle bars, spikes and bolts, and unload new ties. This of course necessitates a large number of men on the work train but as only one engine and train crew is required for loading or unloading several cars at a time, it reduces to a minimum the cost of work train service and aids tremendously in the conservation of equipment. Motor cars can often be used for distributing material under certain conditions, thus saving the use of work train crews, locomotives and other rolling stock.

The nature of some work incident to the repair of track and structures is such that in order to expedite the work and in the interest of safety and economy, slow orders should be placed where the work is being done, the speed limit depending on the nature of the work and its relation to the safety of traffic. As the use of slow orders is liable to interfere with the regularity of trains they should be employed only when absolutely necessary. All railroad officers consider the safety of passengers and trains of first importance and railway managers insist that all repair and construction operations must be subordinate to the punctuality of trains and the comfort and convenience of patrons. However, it has been found that in some cases the best interests of the company are served by diverting traffic from one track to another while doing certain kinds of work on track and structures on multiple track lines. For example, I have in mind an instance where it was necessary to do a large job and after carefully preparing an estimate of the time required to do the same work under similar conditions it was found that it would take six weeks to do it without interruptions to traffic with a large force of men, expensive equipment and the use of one and sometimes two work trains. It was therefore decided at a joint meeting of officers of the operating and maintenance of way departments that the traffic should be diverted to another track and the maintenance of way department be given the use of the one track until the work was completed. With this arrangement the work was done in five days, while detouring of trains was handled in such a manner that train detentions were not noticeable. Thus it is that work requiring the use of slow orders or detouring of trains can be carried on successfully without any noticeable interruption to traffic.

It has been suggested improvements and construction should be deferred as much as possible to assist in the movement of traffic. This will only afford temporary relief and the ultimate result instead of being beneficial will prove detrimental to railway progress. Railway managers realize this and in order to meet the 1923 peak have been and are enlarging and improving their facilities. These vast improvements are based upon the faith of the managers and stockholders that the government and the public will continue their policy of co-operation and will oppose measures desired to break down the railroads and force government ownership.

Prompt Attention to Defects Will Save Many Delays

By D. F. Stevens,
General Superintendent, Baltimore & Ohio, Cleveland, Ohio

The ability of the maintenance of way officer to so conduct his department as to assist in moving the peak business is largely restricted by the policies in vogue on most American railways in limiting maintenance of way expenditures in the lighter traffic months when earnings are light and then opening up the pocketbook for heavy expenditures when traffic is at its peak and track occupancy is the vital factor in handling the movement. In this respect the controlling factor is not the maintenance of way officer but the policy of the company which I assume is governed by its ability to finance these expenditures during the slack months of the year.

Commencing in September the traffic chart shows an upward tendency, reaching its high figure in October and November, continuing high in December and January and gradually decreasing so that by April the chart is near its bottom mark and continues so until September again. It is the belief of the writer that, finances permitting, materials for maintenance of way work should be distributed early in the year and as much of it as possible should be on the ground by April 1. This applies particularly to ties, rail and rail fastenings, for ballast can be handled during the summer months when track occupancy is at its minimum.

The writer, in his early days as a section foreman on a branch line of one of the trunk line systems, in company with the other foremen of that territory always considered it a disgrace not to have all of his ties in the main tracks by July 1, leaving the balance of the season for lining, surfacing, ditching and similar work which does not interfere with the heavy traffic. Today we find the heavy work of renewal going on sometimes into December, which in my opinion is absolutely wrong. Incidentally, the productivity of men in heavy work is much greater in the early cooler months than it is during the hot middle and late summer. Whether this can be controlled is a matter for the executives who handle the finances to determine, but it at least seems desirable from the standpoint of maintenance and operating officers.

The matter of ditching by trains is one which calls for track occupancy. The use of trains is needless in many cases for this work can be done except in isolated cases with wheelbarrows, teams or by running small dump cars on outside rails in the cuts and avoids the occupancy of the tracks entirely.

Of course the matter of distributing ties varies largely with the traffic on the line, but it is the writer's experience, even in a most congested territory with which he is familiar, that by proper planning and handling one or two cars a day on the local freight trains most of the ties on a division can be distributed during the winter without any additional train service by utilizing the local freights in this manner. The same is true to a lesser extent in rail distribution.

All of the turnouts from main tracks should be laid with rail the equivalent of the main line section back to

at least the clearance point and they should be tied to full main line strength. An analysis of many smaller derailments will show that they are due to improper maintenance of the turnouts from the main track. The necessity for inspection of frogs and switchpoints, of the bolts and connections and of tie rods on switches should be constantly impressed on supervisors and foremen. Many derailments result from lack of inspection and repairs to these fundamental parts of the track.

The use of the reverse track for movements is becoming more and more necessary with the increased growth of traffic and the inspection of facing point switches against the current of traffic should be strongly urged on the section foreman.

Most maintenance of way men will tell one that if they can keep track dry they can maintain good track and yet one can go over almost any section of track and find that in many instances the side and cross drains are not kept open for the passage of water with the result that bad joints develop because of poor drainage which could have been corrected in five minutes before the trouble happened.

The accidents chargeable to the maintenance of way department which contribute most largely to slowing up traffic during peak movements are, in the writer's opinion, not main line derailments but those occurring in busy yards in the large terminals and are due in the main to letting the yard maintenance wait until the main track maintenance is cared for. I have seen congestions that took a month to clean up result from a derailment at a hump because of an improperly maintained switchpoint or turnout when an hour's work at the proper time would have avoided the situation.

It is becoming more and more apparent to the writer that the constant retaining of a uniform number of men on track work as against throwing in large volumes of poor imported labor during periods of heavy traffic is much the better plan and tends to give a better railroad to run on. In times when business is slack the maintenance of way forces are usually reduced to the minimum. If the necessary amount of money can be carried over to cover those lean years, the heavy maintenance work should be taken care of in the periods of slack business when track occupancy is not so vital, when good labor is available and when material can be procured at a reasonable figure.

A Seasonable Program Will Keep Work Out of the Way of Traffic

By C. J. Lepperd

Supervisor, Philadelphia & Reading, Pottstown, Pa.

The season of peak loads for grain carriers is that just at hand. Coal carriers usually are busiest during the winter months and ore carriers when business conditions are good and water transportation is available. The season varies but every common carrier has its time of peak loads which almost always may be anticipated by the traffic department.

In spite of this seasonal variation certain cardinal principles apply to every peak load. Among them a very important one is the conservation of equipment. The three principle commodities received by the maintenance of way department are ties, rail and ballast. The season for the purchase of rail generally is beyond the jurisdiction of that department and it must be unloaded when received. The loading and redistribution of secondhand rail as well as the laying of new or second-hand rail should not be attempted while traffic is heaviest. In addition to the interference with traffic a further objection is the higher cost at that time. The season for ballast renewal is during and immediately after that for tie renewals. To have this work out of the way of autumn grain and coal movements the first and most important step is to complete the tie renewals during the spring and early summer. This necessitates the early distribution of ties. Where weather permits every tie to be used during the season ought to be delivered and piled in small piles as near as possible to its final location during the winter, and, if weather conditions prevent this then during the early spring. This will not result in the waste of good wood if the ties are ordered by locations and distributed accordingly.

The principle aid for the conservation of equipment by this department is for it to have sufficient equipment of its own so that revenue cars need not be used in tie and ballast service. Traffic is expedited by the quick handling of such materials along the line. Heavy rail and dense traffic have brought the power rail loader into general use but much ballast is still handled in coal cars instead of in ballast cars which will deliver the ballast quickly and uniformly wherever wanted, either between the rails or in the center or side ditches. The responsibility for proper equipment rests with the higher officers of the department.

The co-ordination of maintenance work with that of other departments requires a definite program and efficient organization. Preparedness should be the motto. This, of course, implies the necessary co-operation of other departments and an adequate labor supply, both of which are often beyond the powers of maintenance of way men but generally the head of the department can be held responsible for meeting these conditions successfully. The necessary program should be formulated one year in advance and should be made by those who know the details of the work and are well acquainted with the road and the needs of the various branches and divisions. Where weather conditions do not prevent, rail should be laid during the winter, and tie and ballast renewals made during the spring and summer, leaving the work of surfacing in preparation for winter to the autumn season which for most railroads is the season of peak load traffic.

Foremen and supervisors are responsible for ordering necessary materials and the preparation of an outline of the work for the year ahead but the higher maintenance of way officers must make the program and see that it is executed. Rail should be allotted and distributed, ties delivered to proper locations and ballast ordered and shipped at the proper season if a program is to be effective. If an outside supply of labor is required or expected to be required, the proper housing and feeding of the men must be planned months in advance for the reason that camps cannot be outfitted in a few days.

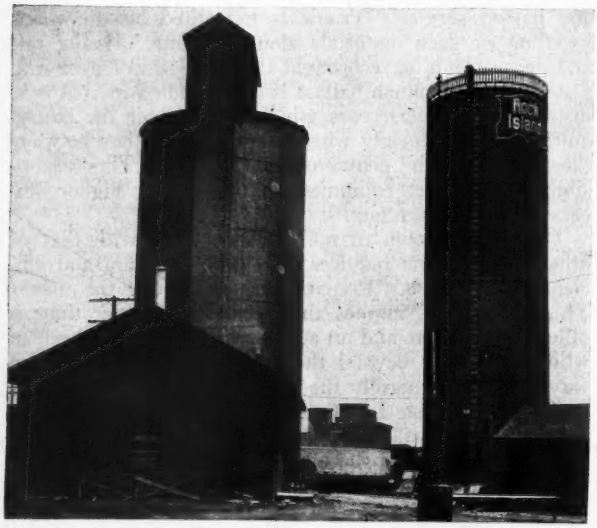
Maintenance of way work is often held up waiting for small supplies such as rail fittings, tie plates or spikes. This should not occur if the stores department is given adequate notice of the amounts needed.

To assist in carrying a peak traffic load the maintenance of way department must co-ordinate its work so that its equipment is kept out of the way at that time and must put its tracks in condition for the load. The latter cannot be done in a month or two but will be the result if its work is planned and executed in advance. Its officers must see that the department has adequate equipment and an adequate supply of labor, sufficient material when needed, and a practicable program and that the program is executed.

New Rock Island Water Station Saves Over $12,000 Annually

Modern Theories Applied to Advantage and Unusual Details Worked Out in Relieving Bad Situation at Chickasha, Okla.

IN 1916 the Chicago, Rock Island & Pacific made an investigation of water supply conditions over the system. This investigation disclosed the fact that Chickasha, Okla. was among the points most in need of attention. Steps subsequently taken to improve the situation at that point, led to the dismantling of the existing facilities, including a water softener, and the building of an entirely new layout. The new plant, which is now in operation, comprises a battery of electrically operated tubular wells, together with a collecting reservoir and a large continuous type softener. The installation occupies a particularly prominent place among the water supply facilities undertaken in recent years because of the attention given to the consideration of the qualities of the water.



Looking North Toward the Treating Plant

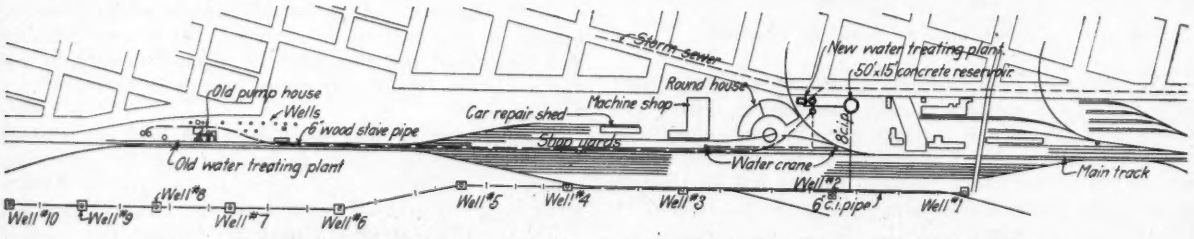
There are ten wells in the new layout, each 8-in. in diameter and 65-ft. deep. These wells are located about 600-ft. apart on the right-of-way east of the tracks, and have individual pumping units consisting of a single acting deep well pump, driven by an electric motor of 5 hp. belt connected to an adjustable working head, all enclosed in a 6-ft. by 14-ft. frame housing with gallows frame. The water from these wells is discharged into a 6-in. cast iron pipe line which carries it a maximum distance of a mile to a point opposite the treating plant, from which it is conducted across the track, a distance of 200-ft. to the collecting reservoir, a reinforced concrete structure 15-ft. deep and 50-ft. in diameter, holding 200,000 gal.

From the reservoir, the water is pumped into the treating plant, of a 300,000 gal. capacity, designed to handle water at the rate of 30,000 gal. per hour, allowing a minimum of 5 hours for settling. It comprises a steel tank 50-ft. in diameter and 60-ft. high, the upper half of which is arranged for storage. A 20 hp. oil engine, belt-connected to a 500 gal. per minute triplex pump supplies the water for this plant. The chemicals are mixed in a small steel tank and then discharged into a larger tank where agitation is maintained by a small electric motor. The solution tank will hold chemicals enough for 12 hours of treatment, which chemicals are elevated by a chemical pump, chain-drive connected to the triplex pump so as to work synchronously with it. This equipment is situated on the ground level within a 24-ft. by 48-ft. frame housing which also provides storage space for the chemicals.

The water from the reservoir is pumped to the top of the plant where it furnishes the power to a water wheel required to drive two sets of agitators which intermesh as they revolve in opposite directions in an 8-ft. reaction tank. The water is retained in this tank for about 45 minutes before it emerges from the bottom. It then rises in the settling tank at the rate of about six feet per hour, during which the precipitates fall to the bottom where a system of perforated pipes is provided for their removal. This sludging system is connected with the city sewer. As the water reaches the top it enters the 12-in. outlet pipe and flows by gravity to a 20-ft. by 60-ft. steel stand pipe, where it is ready for distribution.

The Old Layout Had Numerous Faults

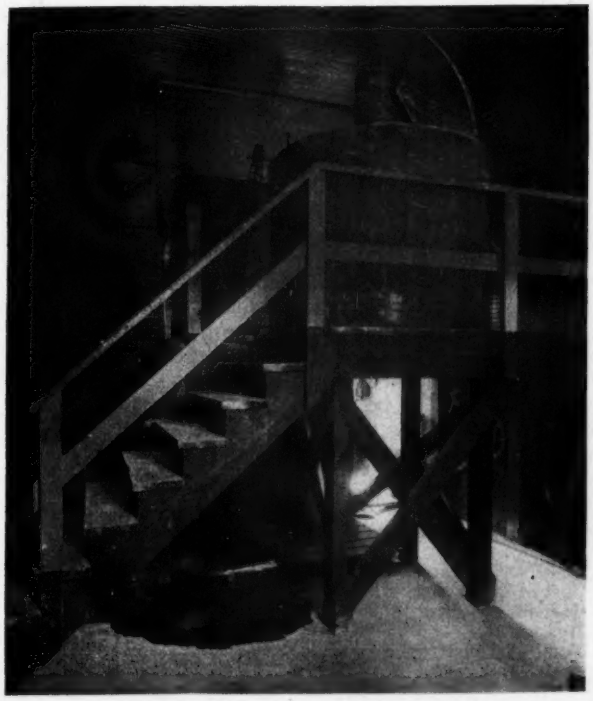
This plant replaced an old layout which comprised a series of wells closely spaced on the west side of the track about three-quarters of a mile from the station. Ten wells were in use, each 4-in. in diameter and 62½-ft. deep. These wells were air-lift operated and discharged through tile drains into a dug well 18-ft. in diameter and 28-ft. deep, after which the water was subjected to the softening process in an intermittent plant, employing two 20-ft. by 30-ft. tubs, and subsequently pumped through an 8-in. wood stave pipe to the 20-ft. by 60-ft. steel tank mentioned in connection with the new plant.



Ground Plan Showing the Layout of the New and Old Water Facilities at Chickasha, Okla.

The cost of operating this plant was excessive. The air-lift method of pumping was installed on the theory that mechanical pumping would injure the sand stratum in the wells, which is very thin at that point, and would cause sanding of the pump. It was also thought that

the air-lift pumping would more nearly develop the capacity of the wells. Owing, however, to the limited submergence afforded in the wells and the necessity of maintaining a separate plant to supply the air, consisting of one 70 hp, and one 80 hp. boiler with steam pumps,



The Chemicals Are Mixed in Steel Vats

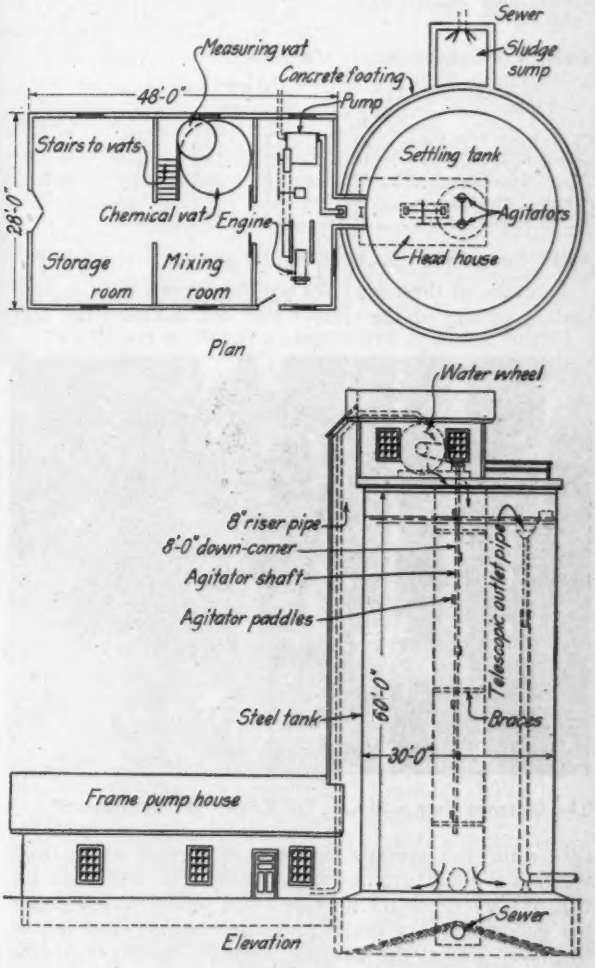
air compressors, etc., the air-lift method was never efficient and had become more expensive with the depreciation of machinery and the increase in the cost of coal, labor, etc. In 1920, when 41,149,000 gal. of well water was furnished, it cost $9,682 to operate these wells, exclusive of the cost of softening and $2,000 for repairs, or 23.5 cents per 1000 gal.

These wells, furthermore only furnished about one-half the water required, making it necessary to depend upon the city for the remainder, which amounted to 40,115,000 gal. in 1920. This water was obtained from the Washita river and while costing considerably less than the well water (12 cents per 1,000 gal. in 1920), it differed to such a degree from the well water as to make satisfactory softening difficult under the most favorable conditions, and under the conditions which existed it was practically impossible. The intermittent treating plant, built in 1908 or earlier, never was highly efficient and had not only become worn out, but was no longer of adequate capacity. Although both well water and river water were highly unsatisfactory for boiler use untreated, it often happened that well water was furnished raw and even when treated, it was seldom in the best condition. In conducting the treatment, the method pursued, was first to pump into the tub what well water was available, fill the remaining space with city water and then to treat this uncertain mixture.

A Thorn in the Side of the Mechanical Department

The result of these conditions, aside from contributing to increase the cost of plant operation by reason of the greater attention required, was to cause leaking, foaming and pitting of the locomotives. It was said that a road engine using the raw city water in a new boiler would leak at the end of the first trip and require new flues in 60 days. While this condition was greatly improved by mixing the city water with the well water, it was found that the three switch engines using the Chickasha water exclusively, required new flues once between general shopping or about every six months at a cost of about $3,000 per engine.

The imperfect operation of the treating plant also resulted in much clogging of pipes, and extra work for cleaning out of tanks. The extent to which this trouble occurred is shown by the fact that in 1914, after about seven years' of water treatment, it was found necessary to renew all of the ¾ mile of 6-in. line between the treating plant and the water tank because the opening had been reduced to from 2½ to 3-in. by incrustation, and that



General Details of the Softener

in 1918 this line was again renewed for the same reason, this time with 6-in. wood pipe. Furthermore, only recently, it was discovered that 300-ft. of the 12-in. pipe line serving one of the two water columns will require replacement from this cause, notwithstanding that this line received its water from the 20-ft. by 50-ft. stand pipe, which is located ¾ miles from the old softener. It was to meet these conditions and the further condition that the well supplies were showing signs of failure, that the new work was undertaken.

City Water vs. Well Water

Having become satisfied that the water should be obtained from one source to avoid the irregularities of mixing, it became a question whether to secure all water from

the city, or to develop a new supply. It was a general belief that the city water was less suited for boiler use than the well water in the neighborhood, but since there was some doubt about this, a series of analyses were made of each water, these analyses extending over a year. The result of the separate analyses and the dates when made are given below, the well samples representing a mixture of water from all of the old wells, and the river samples being taken from the hydrant.

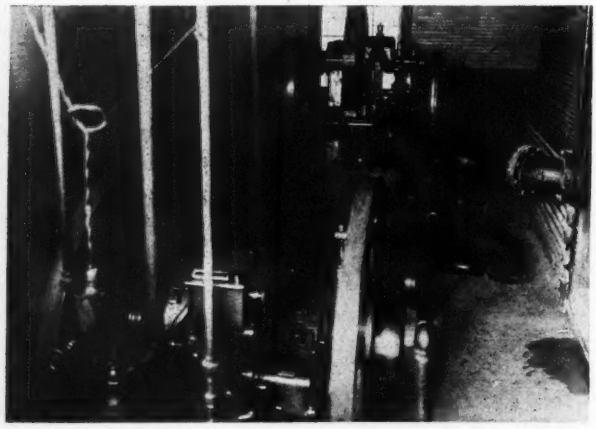
ANALYSES OF RIVER WATER SAMPLES

	July	Oct.	Dec.	Feb.	Average
Carbonate Hardness..	10.6	5.8	15.0	17.1	12.0
Sulphate Hardness....	33.9	17.6	44.0	51.2	36.4
Total Hardness.....	46.7	24.5	59.1	68.9	50.0
Alkali Solids.....	7.6	1.4	10.7	14.4	9.0
Total Solids.....	53.9	26.3	70.2	83.3	59.0
Alkali Solids plus Sulphate Hardness.....					45.0

ANALYSES OF WELL WATER SAMPLES

	July	Oct.	Dec.	Feb.	Average
Carbonate Hardness..	21.5	25.3	23.6	19.3	22.4
Sulphate Hardness....	16.3	9.5	11.3	12.0	12.2
Total Hardness.....	38.5	35.1	35.1	31.8	35.0
Alkali Solids.....	8.6	14.7	15.7	15.7	13.7
Total Solids.....	47.1	50.3	51.1	47.5	49.0
Alkali Solids plus Sulphate Hardness.....					26.0

A review of these analyses not only brings out the fluctuating quality of the river water but discloses the fact



The Softener Uses a 20 h. p. Oil Engine and a Triplex Pump

that while the average carbonate hardness of the well water is about 10 grains per gallon more, or nearly double that of the river water, and the alkali solids about 4 grains per gallon more, or nearly half again as much as that of the river water, the average sulphate hardness of the river water is 24 grains per gallon more or three times the sulphate hardness of the well water, and is 39 grains more or more than four times the hardness of the well water at some seasons of the year. It will also be noticed that the average amount of total incrusting solids is 15 grains more or nearly half again as much as the total incrusting solids of the average well water, and double the quantity at some seasons of the year. Such a water, manifestly, will not only cost considerably more to soften by reason of having more incrusting salts present, but will also be more difficult to soften properly by reason of the greater amount of sulphate hardness present.

The Modern Theory of Corrosion Was Applied

There is another feature, however, which the analyses bring out which exerted more weight than the probable difference in cost of treatment. It was to find out which of the two waters would be the more suited for boiler use after treatment. It is well known that when treating a water, some of the alkali salts occurring in the natural water, while they may be changed in form, are not removed by the softening process. It is also known that when removing sulphate hardness, an equivalent amount of non-incrusting substance is left in the water, the effect of which with the alkali salts (according to a general belief concurred in by the Rock Island), is not only to promote foaming with all its evils, but also to promote corrosion. It is interesting to notice again, therefore, that while the average amount of alkali salts was greater in the well samples than in the river samples, the sulphate hardness of the river samples is much greater in proportion, leaving an average of about 45 grains of dissolved solids for the *treated* river water as compared with 26 grains for the treated well water.

The result of reviewing these analyses was to remove the one obstacle to carrying out the proposed plan. This was to select a location on the right-of-way removed from any possible extension of yard facilities and to sink a series of wells down about 63-ft. where a stratum of sand and gravel was to be found immediately overlying beds of red shale.

By operating these wells electrically it was proposed to save $11,600 in operating costs alone. This was arrived at as follows:

EXISTING CONDITIONS

Cost of city water, 40,115 m. gal. at 12c...	$4,813.80
Cost of well water, 41,149 m. gal. at 23.5c..	9,682.33
Cost of treatment, 81,264 m. gal. at 5c....	6,376.84
Total cost of treated water.....	$20,817.17

PROPOSED LAYOUT

Cost of pumping, 81,264 gal. at 10c.....	$8,126.40
Cost to treat, 81,264 gal. at 5c.....	4,063.20
Total	$12,189.60
Partial Saving.....	$ 8,627.57

Since it was expected to find a better water than the city water by at least 5 grains per gallon as regards incrusting solids, which is equivalent to a difference of 29,384 lb. of incrustant, costing 10 cents per lb. to remove, it was further proposed to increase the savings as follows:

29,364 lbs, at 10c.....	$ 2,936.40
Total saving in cost of treated water.....	$11,563.97

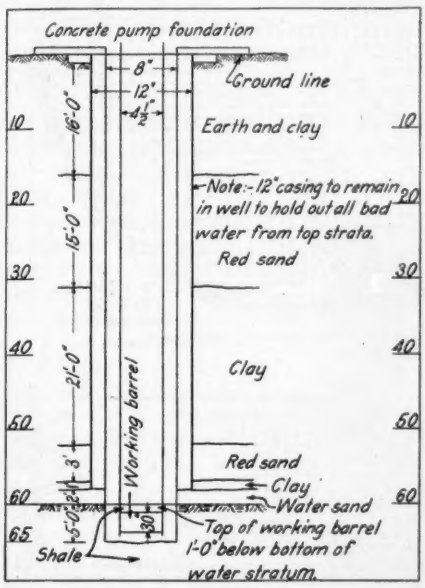
Mention was also made of the saving in fuel required for frequent blowing down of boilers, using the old water and of the intangible but real savings from a reduction in corrosion.

The Water Bearing Stratum Is Thin

While the water bearing stratum was known to be only from 2½ ft. to 4 ft. deep, there was no doubt about getting sufficient water from this stratum, as a number of wells in Chickasha had been pumped from this depth for the past 15 or 20 years, including the wells then in operation by the Rock Island—the dimunition in the supply from the latter of which was attributed to their close spacing and faulty condition rather than to a depletion of ground water. This stratum, moreover, was known to furnish the best grade of ground water to be had in the vicinity. In comparison with it, for instance, a sample taken from a 22-ft. well near the right-of-way, was found to contain 119 grains of incrusting solids and 151 grains of dissolved solids.

The one possible cause for anxiety was rather with reference to the success with which pumps could be

operated in these wells. When placing the existing wells, as has been mentioned, it was thought that mechanical pumping would not be feasible owing to the thinness of the water-bearing stratum and the fineness of the sand. While this opinion had become modified with time, it was still apparent that care must be exercised in designing and equipping the wells. It is not surprising, therefore, that it was proposed at first that the wells should have two casings, a 20-in. casing outside, and a 6-in. casing inside, with fine gravel packed in the intervening space. It was further proposed at that time, that the 20-in. casing should be driven to a point about 10 ft. below the water-bearing stratum to provide for a gravity flow into the working barrel of the pump. Later, when it was found that no trouble had been experienced from caving in of sand, it was thought sufficient by the division forces to confine the work to drilling a 10-in. hole and placing a 6-in. casing and strainer.



Sketch Showing the Log of One of the Wells and the Method of Construction

The plan ultimately adopted was to establish 8-in. wells by first sinking a 12-in casing to a point about 5 ft. below the water bearing stratum, and following this with an 8-in casing fitted with a strainer, after which gravel was to be placed around the strainer and the 12-in. casing removed. There were to be 10 wells placed as it was figured from the records of the test wells of an earlier period that each well would furnish from 20 to 35 gal. per minute, according to which 10 wells would provide a reserve against breakdowns and permit the pumping of the day's requirement in 8 hours. As originally proposed, three of these wells were to be located north of the treating plant, and the remainder at intervals to the south.

The First Wells Were a Failure

In proceeding to place the wells, however, complications arose which resulted both in a modification in the design of the wells and revisions in their location. After having sunk three of the proposed wells, it was found that the quality of the water was much worse than expected. The explanation was suggested, however, by the logue of the wells. By referring to the accompanying diagram, it will be noted that there are two sand layers above the proposed source of water. It developed that each of these top layers of sand carried about a 120 grain water (the same evidently as was found in the 22-ft. well mentioned above). It was decided that this water was filtering into the better water of the lower stratum, where it was making it entirely unsuited for use. Upon the strength of the discovery, two of the first wells were plugged with concrete and a 16-in. casing was sunk over the third well down to the stratum immediately below the lower of the two upper water-bearing veins. In addition, it was decided to drive a permanent 12-in. casing to the same point when placing the other wells. It was thought that this would effectually keep out the bad water.

About the same time an old open well was discovered in the vicinity which aroused suspicion. This well, it was found, had been hand dug to a depth of 30 ft. and roughly walled with rock, beyond which an 8-in. pipe had been driven to the same water-bearing stratum to which the Rock Island was drilling. Upon the belief that this well, by affording a communication between the several water-bearing layers, was contributing to the excessive hardness of the well water, an agreement was entered into with the owners, whereby the old well was plugged and a 6-in. cased well provided in its place.

With these instances in mind, cognizance was then taken of the fact that the district north of the treating plant in which it was proposed to place three wells, is occupied by numerous manufacturing enterprises, which might eventually develop well supplies. Since these industries might increase in number in time, and the wells built establish quite as potential a source of pollution of the desired source of supply as the open well mentioned, it was decided to place only one well north of the treating plant and re-arrange the original layout to provide for additional wells to the south.

The Water Is Better as the Wells Proceed South

The wells were completed without further incident except for the substitution of strainers having .024-in. apertures for strainers of only .006-in. apertures, the change having been made early in the work when the first well, fitted with the finer strainer, failed to deliver more than 16 gal. per minute. As completed, each well is finished on top with a concrete slab and carries a 4½ drop line with the working barrel located one ft. below the water-bearing stratum. Since their completion, some trouble has been experienced with sand, which it is expected will continue in a few of the wells for some time, but this is met by requiring some pumping in each well daily. It has also developed that the first and last wells in the series are quite dry, a condition which is met by avoiding continuous pumping. Perhaps the most interesting observation with respect to the new wells is the disclosure made by analyses of the well waters several weeks after operations commenced. The results of these analyses are as follows:

One of the Well Pumps

ANALYSES OF NEW WELLS

	1	2	3	4	5	6	7	8	9	Av.
Carbonate Hardness	30	36	31	41	32	26	26	25	23	30
Sulphate Hardness	7	37	32	45	20	18	14	6	3	20
Total Incrusting Solids	37	76	65	88	52	46	40	32	27	50
Alkali Solids	11	23	23	44	31	18	23	13	7	21
Total Solids	49	99	88	133	83	64	64	44	34	72

It will be noticed not only that the waters differ considerably from each other, but that beginning with the fifth well the water in each well progressing south is better than that in the preceding well, the water in the last well being much better than that even in the sixth well and considerably better than that of the wells further north. Whatever else this difference suggests, it has emphasized the importance of the collecting reservoir.

The Cistern, an Equalizer of Different Waters

The reservoir into which all the well waters are discharged before treatment was intended to perform several functions: (1) To provide sufficient capacity to avoid irregularity in the volume of flow to the treating plant independently of any mechanical contrivances; (2) to equalize the quality of the several well waters and thus prevent irregular variations in the quality of water being treated; (3) to provide a reduced head on the several well pumps, permitting the least expensive equipment there; (4) to reduce vibration in the wells, common where pumps operate against high lifts, and (5), to minimize the delay involved when the treating plant is temporarily out of service. In performing each one of these functions, the reservoir serves a valuable purpose, where erratic fluctuation either in quality or quantity results in alternately under-treated and over-treated water, which, if it is improved at all by after mixing, results in after-precipitation in places other than the settling tank.

This reservoir is half below and half above the ground, and is designed to withstand the internal pressure independently of lateral support. One-half-inch corrugated bars are employed for the reinforcing with an upper and a lower layer of reinforcing on the bottom with stirrups at the junction with the wall. The wall is 6 in. in thickness. In order to insure water tightness, a quantity of lime equaling 10 per cent of the cement was added to the mixture and the concrete was placed in one continuous run. The reservoir has proved to be watertight, no leaks having developed in it thus far.

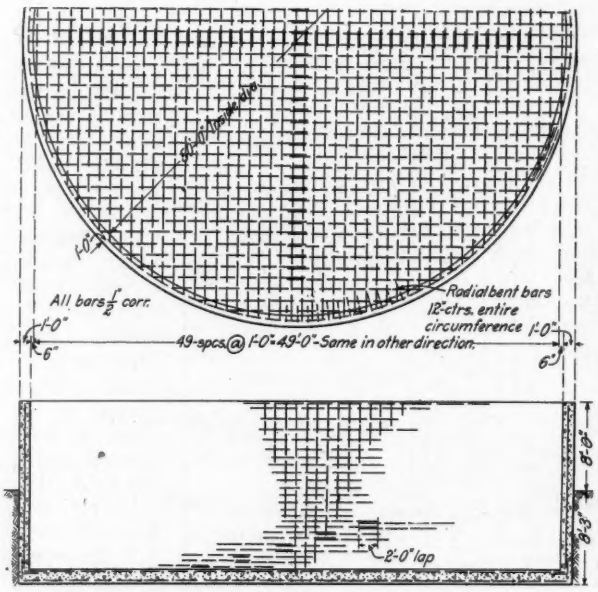
Better Agitation Produced Better Water

The softener has also proved equal to expectations, although when the softener first began operation, the hardness of the water persisted in running above seven grains and in addition more chemicals were required to treat the waters than experience could justify. After some experimenting it was found that an increase in the amount of agitation seemed to produce a better water, whereupon the agitator paddles were increased in number up to the full carrying capacity of the water wheel, with the resultant reduction in the need for chemicals and the ability to keep the hardness well below 5 grains.

The plant is a substantial structure and is somewhat unique in having no proportioning device for the chemical, the chemical feeding being carried out, as described earlier, by means of a pump operating in unison with the raw water pump. Since the triplex pump, being a reciprocating pump, displaces a definite quantity of water with each stroke, the chemical pump thus feeds a uniform flow of chemical. It is interesting also to note the details of the overflow from the treating plant to the storage tank. The upper 20 ft. of water in the treating plant is drawn off by a galvanized pipe which is suspended from a float and telescopes in the outflow pipe as the water in the settling tank rises or falls. This water is then discharged near the bottom of the storage tank rather than entering at the top. This promotes the clear water at all times and permits a larger storage capacity which, while seemingly excessive, is not considered so when it is stated that this additional storage makes it possible to confine all pumping to one shift at a very considerable saving annually.

The Cost of Water Has Been Reduced $12,000 a Year

The work at Chickasha was undertaken in March, 1922, and, after some interruptions, including the partial burning of the treating plant, was completed and placed in operation in June. The cost was high, exceeding $75,000, but not out of proportion to the improvements effected. Before undertaking the work it was estimated



The Details of the Collecting Reservoir

that an annual saving of $11,000 would be made in the cost of furnishing the water alone. That this has been accomplished appears to have been established from records kept for the four months immediately preceding and immediately following the use of the new plant. During the four months of March, April, May and June, 1922, 24,353,000 gal. of water was furnished at a cost for operating the steam plant, buying city water, and softening of $7,095.88 or 28.7 cents per 1,000 gal. As compared with this 26,913,000 gal. of water was furnished during the subsequent four months at a total cost, including treatment, of only $3,073.05 or 11.4 cents per 1,000 gal. The difference in cost is $4,022.23 for the four months or, in round numbers, $1,000 per month, a saving per year equivalent to 15.7 per cent of the actual cost of the new plant. In addition, substantial improvements resulted from the improved quality of water furnished locomotives, the results being such that any falling off in the proper operation of the treating plant is at once detected and complained of by the mechanical department.

The work was carried out under the direction of C. A. Morse, chief engineer of the Rock Island and P. A. La-Bach, engineer water service, while the plant was built under contract by the Railroad Water and Coal Handling Company, Chicago, except for the electric wiring and the installation of heating facilities which was done by company forces.

A MEMORIAL—A "golden rail" is to be set into the track on the Union Pacific, as a memorial to President Harding, who presided at the opening of the line to that point on June 27.

It Is Much Better to Lead Men Than to Drive Them

Mr. Downs Says That No Man Can Afford to Rely Entirely on Native Ability in Directing the Work of Others

By WALTER S. LACHER

"HANDLING MEN is largely a matter of getting them to like you. If you can't gain their good will, you can't expect to get their best efforts."

This sentiment is a far cry from the bulldozing tactics which prevailed in the "hard-boiled" days of the past when men won advancement largely through sheer force of brute domination over others, but it is particularly significant as coming from a man whose physique, physiognomy, bearing, voice and address all manifest the commanding personality which functions effectively without the aid of agencies designed to influence the will to obey or acquiesce. Lawrence A. Downs, vice-president and general manager of the Central of Georgia, a past president of the American Railway Engineering Association and recently a United States delegate to the International Railway Congress at Rome, is a born leader, but he insists that no man can afford to rely entirely on native ability in directing the work of others.

Lawrence A. Downs
Vice-President and General Manager, Central of Georgia

"It is much better to lead men than to drive them," Mr. Downs explained. "I rarely find it necessary to give a man specific instructions to do something a certain way. It is much better to direct by suggestion. If I say to one of my assistants, 'If I were you I would do it so and so,' I find that it is almost as certainly done that way as if I arbitrarily ordered it to be done so, but with the advantage that I have retained the man's good will."

"I liked to work for Mr. Downs," said an Illinois Central officer who was on his staff when he was a general superintendent of that road, "because of the way he conducted the business that came before him. He lets you know what he wants, but with a degree of latitude that affords a chance to exercise some initiative. If the result does not suit him he will tell you but in a way that does not offend. But don't get the idea that he is an easy man to work for, because you have to 'hit the ball,' and if you don't hold up your end, he isn't going to help you to do your own work. He expects every man to measure up to his job."

Mr. Downs explained his views on supervision in greater detail.

"The idea of making men like you must go further than a mere personal relation. It should include efforts to instill loyalty to the company and to the other officers in the organization. I always make it a point to tell men of the efforts which their immediate superiors are making in their behalf.

"There are few phases of a railway officer's work which should receive closer study than the matter of dealing with his men. I suppose most men who have been promoted from the maintenance of way department to the position of superintendent in the operating department have had serious misgivings about their ability to get along with the train service employees or other groups of highly organized labor. It worried me a great deal, but I found out in a short time that it was one of the easiest parts of my work."

"What are the requirements for success in that work?"

"Negotiations with employees require a knowledge of what some people call 'the humanities,' a word which I think explains itself. It also requires that you be fair in your dealings. This does not mean that you must grant every request made of you but that you observe a spirit of fairness, avoiding tricky or underhand tactics in efforts to out-general the men, and above all, that you keep every promise that you make them."

"Mr. Downs, the young men in railway service are anxious to get the views of their officers as to the requirements for success. Do you feel that high aspiration is an important requisite?"

"I do not think that many men enter railway service with the idea that they will some day be president. I

know I didn't. When I was in school, (I graduated from Purdue) it was my ambition to get into the engineering department of a railroad. My thesis concerned railway maintenance. After I got into railway engineering work, first on the Vandalia and later on the Illinois Central, my ambition was to be a roadmaster, and after I gained that promotion, I was just as anxious to become a division superintendent but I had to serve nine years as roadmaster and nearly four years as assistant chief engineer of maintenance before my wish was fulfilled.

"My advice to a young man is to keep the position ahead of him definitely in mind, but to do well the work to which he is assigned no matter what that may be, because any recognition which comes to him will be the result of the showing he makes in the position which he is holding. This means that he must work hard, either by starting early and quitting late, or by exceedingly intensive effort for whatever time he does work."

"Is it a fact that some men stick too close to their jobs to the exclusion of study, observation, or other broadening influences?"

"Yes, but some men are so constituted that they can't get their work done unless they stay with it continuously."

"You spoke of a man receiving recognition because he sticks to his job and performs his work well. Isn't that recognition rather slow in coming sometimes?"

"Yes, I suppose it is, but I admit that it once came to me sooner than I expected, and in fact, before I deserved it. I was promoted to roadmaster on the Illinois Central when I was only 25, a position which was given me by the late John F. Wallace, who was then general manager and is equivalent to that of division engineer on most other roads. Under ordinary circumstances I would probably have been considerably older before I would have been given the place. Of course, after I received the promotion, I had to stand entirely on my own legs to make good."

However, notwithstanding Mr. Downs' observations concerning the circumstances of his promotion to roadmaster, it is to be seriously questioned whether Mr. Wallace, if he were alive today, would agree that he did not have good reasons for promoting young Downs to roadmaster. Indeed facts obtained from others indicate that he had some very good reasons for doing so.

For several months in 1897, Mr. Wallace who had been chief engineer of the Illinois Central was engaged under a leave of absence from the railroad in directing the reconstruction and operation of a large salt and chemical works in Virginia. Early in the course of this assignment he required the services of a skilled machine designer, and in response to a call on the Illinois Central engineering department for a man qualified to take this position young Downs, who had been working as an instrumentman on construction, was sent to Virginia to fill this position. Whether or not the requirements of this position were fully outlined to him before he left Chicago is not clear. At any rate, he was found to be totally without training for the place, much to the disgust of Mr. Wallace who ordered him to go back to Chicago at once.

But Downs had given up his position with the Illinois Central and was not anxious to go back so he looked around to see if there wasn't some other work that he was qualified to do, with the result that the general superintendent of the plant gave him a trial as "superintendent of labor" in place of a man who had gone on a vacation. The duties of this position corresponded to those ordinarily assigned to a general foreman in charge of a large force handling materials in a yard and included supervision over the switching crews. This arrangement was made entirely without Mr. Wallace's knowledge and a few days later when he saws Downs around the plant, he was even more insistent that the would-be mechanical engineer be instructed to leave but was finally prevailed on to let the matter rest for a few days longer.

In the meantime, Downs was doing things. The work of the common laborers was handled with a considerably reduced force. A switching crew that quit was not replaced, yet the work was handled just as well without it. The work also moved a great deal smoother and there was a singular freedom from accidents, breakdowns and other interruptions of the work. The net result was that the general superintendent was able to present such a favorable report of the new general foreman's record that Mr. Wallace not only consented to his staying but was willing to give him the place permanently. It is clear from this that young Downs selection as roadmaster on the Illinois Central after Mr. Wallace returned to the railroad some months later, was not without a definite knowledge of his qualifications.

"Do you find, Mr. Downs, that men who fail to make good in one job, may prove successful in other places? In other words, are some men better fitted for certain kinds of work than others? Or, are the basic requirements so far-reaching that inefficiency in any one of them rules a man out of most positions of real responsibility?"

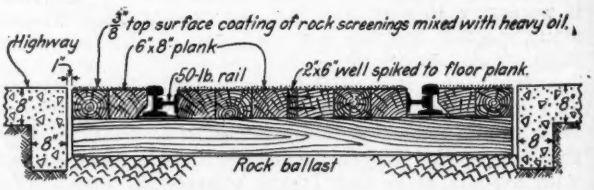
"There are certain well known requirements which must be fulfilled if a man is to succeed in any position, but if he possesses these basic requirements in a reasonable degree of balance, the requirement in any one of them is not severe. In other words, it isn't necessary for a man to be brilliant to succeed. If he is basically sound he can be trained to handle the job effectively. Much, of course, depends upon the training he gets. A man with an able superior will develop much faster than one who is employed under a mediocre man, but education or training is not the main thing. You have often heard it said that 'knowledge is power.' In my opinion that is far from the truth. The first requisite in all cases is character; the next, is industry and it takes these two plus knowledge, to make power.

Old Bridge Ties Make Good Crossing Plank

By G. E. Stewart

Assistant Engineer, Southern Pacific, Stockton, Cal.

SECOND-HAND 6-in. by 8-in. bridge ties can be utilized to advantage for highway crossings. The sketch shows the construction of an improved highway plank crossing using 50-lb. guard rail. The old 6-in. by 8-in. ties are placed directly on the track ties and



A Crossing Built With 6 In. by 8 In. Timbers

fastened with lag screws and the joints are poured with hot oil or asphaltum.

This is an ideal layout for 90-lb. or 100-lb. rail, the tie plates elevating the rail above the stringers a distance of ¼-in., and allowing the planking to be covered with a top coating of rock screenings. A two-inch strip can be substituted for the guard rail if preferred.

Tracks for the Chicago Union Station Supported on Concrete

Providing of Solid Blanket Over Soft Clay Roadbed Greatly Reduces Maintenance Costs

By Joshua D'Esposito
Chief Engineer, Chicago Union Station Company, Chicago

THE TOP of rail elevation of the station and approach tracks of the new Chicago Union Station varies from about 7½ ft. above to over 2 ft. below the water level in the Chicago river which is adjacent to the station site. The highest point is reached only at the south end of the layout and by far the greater part of the tracks are less than four feet above the water level. The blue clay encountered at that elevation is, of course, continually saturated, and consequently has low supporting power. For that reason considerable trouble was anticipated in holding the tracks in satisfactory line and surface with the ordinary type of track construction, particularly since the approach tracks to the old station, which were several feet higher than the new ones, had required what was considered excessive maintenance.

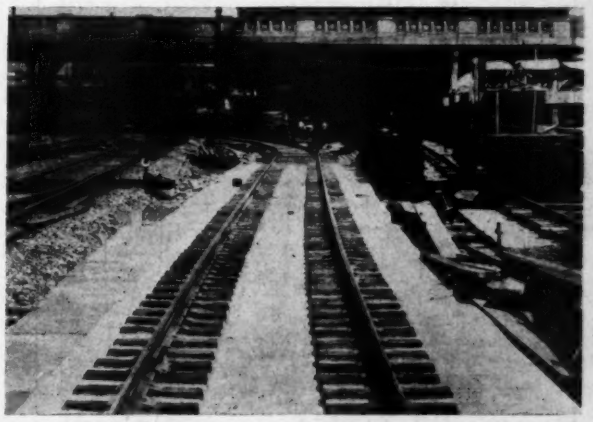
After extended investigation of the situation, which included loading tests on the subgrade and after consideration of the subject by the board of advisory engineers, composed of the chief engineers of the railroads owning the station company, it was decided to minimize maintenance expenses by adopting two types of concrete track support; one for use in the approach tracks and another for use within the trainsheds. As some of the new tracks have now been in service since November, 1920, with a maintenance cost that is remarkably low, it

Completed Section of Approach Tracks North of Randolph Street

is believed that this decision has been amply justified. The only maintenance that has been necessary is an occasional tightening of bolts; no tamping has been needed and no ballast has been added. On tracks similarly located and carrying the same traffic, but not supported on concrete, maintenance costs have been heavy, and the ballast has already required renewal. These facts are so convincing that it was decided to use considerably more concrete track support than was originally planned.

The types of construction used are not entirely new, as similiar slabs have been used by several railroads, including the Long Island, the Pennsylvania and the New York Central. Construction similar to that in the approach tracks has been used under crossings and switches and in places where a soft roadbed has required excessive maintenance, while the station track construction does not differ greatly from that used in several other stations, and in many tunnels.*

Although the concrete track support in the Chicago Union Station is not unique, it is far more extensive than



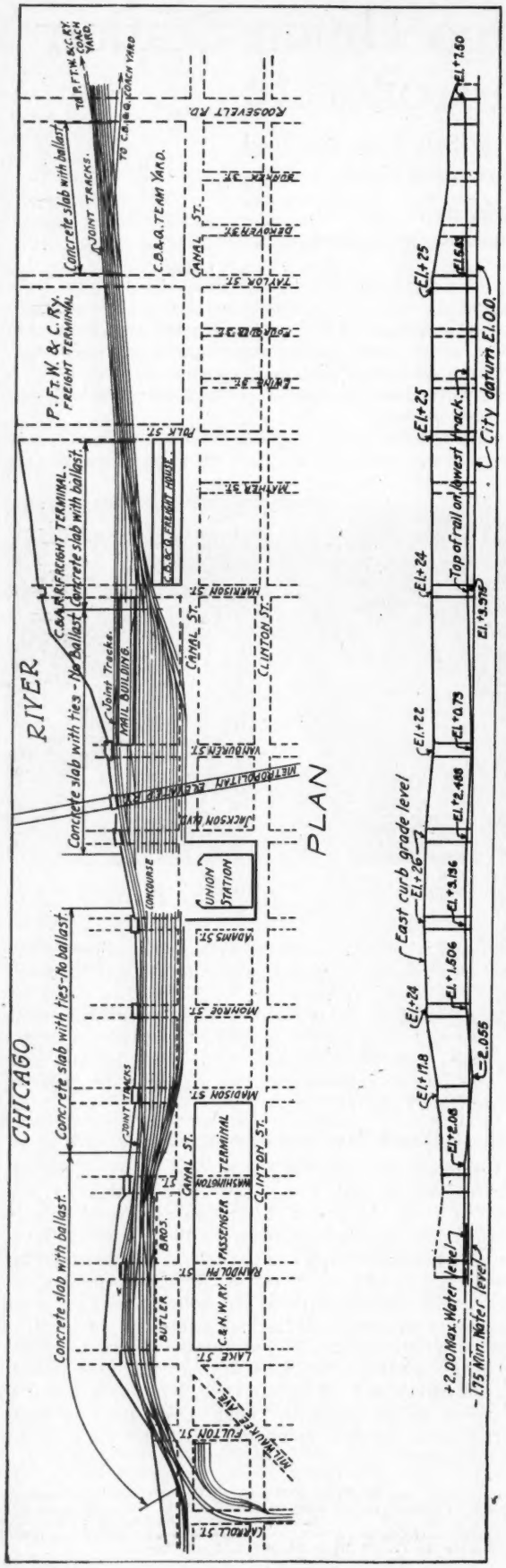
Completed Section of a Station Track South of Harrison Street

any installation with which the writer is acquainted. The total area authorized at present amounts to approximately 1,125,000 sq. ft. (25.6 acres) of 10-in. slabs of which nearly 860,000 sq. ft. is reinforced either with wire mesh or with deformed steel rods, while the remainder, which was used between tracks in the trainsheds, is plain concrete. This is equivalent to over twenty-one miles of single track slab 10 ft. wide.

Approach Tracks of Standard Construction

Beginning near the east line of Canal street, about six hundred feet north of Lake street and extending south to the north end of the north station platforms between Washington and Madison streets, a 10-in. slab reinforced with wire mesh is being laid to serve as a support for approach tracks and crossovers of the usual ballasted construction. The same type of slab is being used under the crossovers and approach tracks between the south end of the south station platforms (just north of Harrison street) and Polk street, under the tracks and crossovers between Taylor street and Roosevelt road, and from Canal to Harrison streets under the "joint tracks" used for transferring cars between the north and south yards of the development.

*A report on the "Use of Reinforced Concrete Slabs to Assist the Ballast in Distributing the Load on Soft Roadbeds," included in the 1920 report of the A. R. E. A. Ballast committee, gives valuable information regarding concrete track supports on nine roads widely distributed throughout the United States and one in South America.



General Plan and Profile of the Union Station Tracks.

All necessary conduits and pipes are laid in concrete ducts below the subgrade, after which a six-inch layer of cinders is spread over it. This layer of cinders is rolled to a plane parallel to the required finished surface of the slab. No other subgrade drainage is provided, but a system of drains is being built to take care of water falling on top of the slabs. Precast inlets or catch basins are placed between all tracks at intervals of about eighty feet and the slabs are sloped so as to drain to them. The latter are connected to pipes running across the yard which in turn empty into longitudial drains that carry the water to sumps located at the low points of each yard. Automatic electric pumps transfer the water from the sumps to the river.

Construction Features

Aggregates are dumped as near as possible to the location of the slab to be laid in order to avoid unnecessary wheelings. It is often possible to unload cement directly

Laying Station Tracks on a 10-in. Concrete Slab

from the car door to the mixer. An ordinary paving mixer is used. Because of the necessity for maintaining traffic it is necessary to complete a portion of the work at a time. The tracks are laid 13 ft. center to center and the slabs are constructed in sections 13 ft. wide by 21 ft. long. The sections are laid in a checkerboard pattern, alternate sections being placed after the first ones have hardened. Tar paper joints are placed between adjacent sections. A wooden strike-off is used to strike the surface level with the forms, further finishing being done with wooden floats.

On these slabs the usual ballasted track of heavy construction is laid. Twenty creosoted red oak ties, 7 in. by 9 in. by 8 ft. 6 in. are used to a 33-ft. rail. The depth of ballast below the ties varies from 6 to 10 in., on account of grading the slabs to drain to the inlets. The rail is standard Pennsylvania 130-lb. section.

Approximately 440,000 sq. ft. of this type of slab will be used. The work is being done by contract, at prices varying from 33 cents to 43 cents per square foot, depending on the time and conditions of the work. As the slab has to be laid a little at a time, and the work so arranged as to affect train movements as little as possible, this cost is higher than it would be under better working conditions.

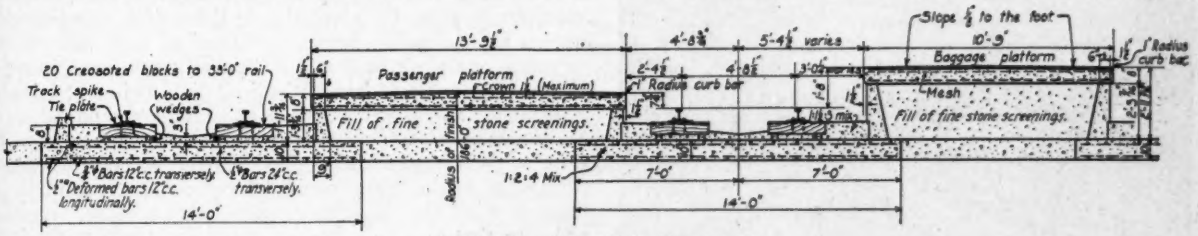
Preliminary loading tests on the subgrade indicated that it had a supporting power of between 2,000 and 3,000 lb. per sq. ft. It is believed that with the track construction above described the pressure on the subgrades will not reach 1,000 lb. per sq. foot as a maximum. With such a low pressure it is thought that, even if the slab does crack to some extent, no trouble will result.

Station Tracks of Special Design

Adjacent to the station platforms and including some of the special work at the ends of the trainsheds an al-

to place the roadbed. Wedges are then driven under every sixth block to bring the track to grade. The gauge is held during construction by wooden struts spiked across between blocks at frequent intervals. After the concrete has been placed there is no further need of the struts and they are removed. The rails used on the station tracks are 100-lb. Pennsylvania section.

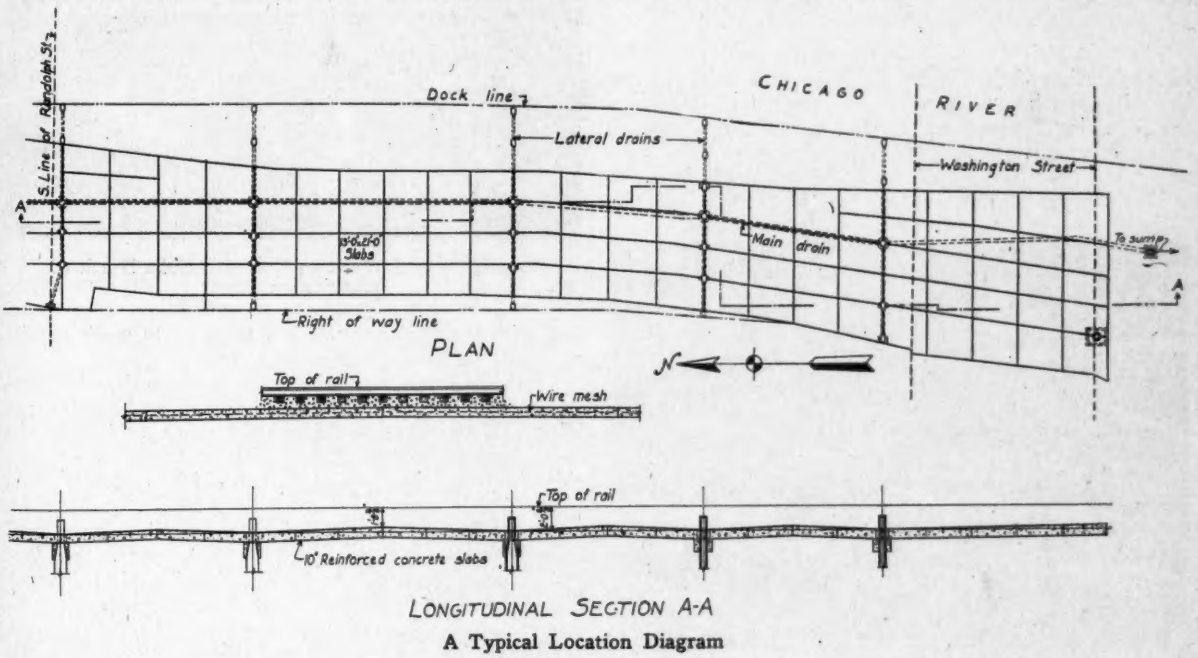
The concrete base slab used for the station tracks, reinforced with steel bars, has cost from 40 cents to 51 cents per square foot, depending upon prices of materials at the time the contracts were let. Approximately 420,000 sq. ft.



Details of the Slab Construction

together different type of track construction is being used, although the concrete slab is quite similar to the one described above. It is 10 in. thick and 14 ft. wide, and is reinforced at the top and bottom with mats of reinforcement as shown. The drainage inlets are located in the center of each track instead of between tracks. Instead of ties in ballast, creosoted wood blocks 6 in. by 8 in. by 2 ft. 6 in. are set in a concrete roadbed rest-

of it will be used. This type of roadbed was adopted because of the ease with which it could be kept clean. The trains on these tracks will be running at low speed, which, it was thought, will eliminate any possible objection to the lack of resilience in the solid concrete construction. Some of these tracks which have been in place for several months have been serving as approach tracks for the present Union Station farther north and are handling



A Typical Location Diagram

ing on the concrete slab. The thickness of this concrete varies from 3 in. between the rails, and below the blocks to 8¼ in. at the outside edges of the blocks. The concrete is a 1:1½:3 mix. Alternate sections are placed as in the slab, care being taken to make sure that the joints coincide. Finishing is done with a wood float. Between the rails and surface is shaped to form a trough which carries the water to drainage inlets at 80 ft. intervals. This trough is finished with a 1:1 mix after the rest of the roadbed has been placed.

The rails are spiked to the blocks, using 6½-in. spikes and 11-in. by 7-in. by ¾-in. tie plates, before starting

heavy traffic at a much higher speed than they were designed for or will ever be required to stand when the station project is complete.

Plain Slabs Beneath Platforms

Separate platforms on opposite sides of each track are being provided for passengers and baggage. Each platform will serve two tracks, one platform being exclusively for passengers and the next exclusively for baggage. Thus there will be no interference between passengers and baggage trucks. Passenger platforms will be 13 ft. 9½ in. wide and 8 in. above the top of rail;

baggage platforms will be 10 ft. 9 in. wide and 20 in. above the top of rail.

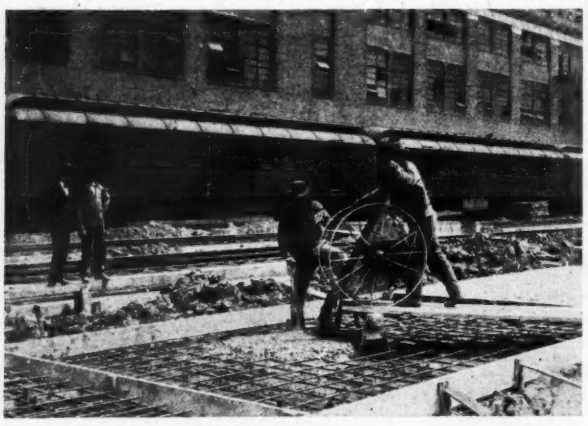
In order to prevent the soft blue clay foundation from working up into the cinder fill below the platforms and permitting settlement of the track slabs, 10-in slabs of plain concrete of 1:3:5 mix will be laid between the track slabs and at the same elevation, thus making a continuous concrete pavement across the trainsheds. The

Looking South Towards Special Work in North Approach Tracks

space between these platform slabs and the platforms proper will be filled with fine stone screenings. Approximately 265,000 sq. ft. of this type of slab will be placed.

Conclusions

The first slab was laid during the summer of 1920, under the slip switches in the south approach tracks in the block just north of Polk street and was placed in service the following November. It was the ballasted type of construction. These tracks have been carrying 198 scheduled trains per day, each of which must back into the station before leaving, or back out after arriving. In



Placing Concrete Slab Under Station Tracks

addition there has been considerable transfer, interchange, freight and mail movement so that the total number of movements has been in excess of 500 per day. Under that traffic the ordinary type of track structure would have required heavy maintenance, which would not only have been expensive but would have obstructed train movements in a region that is congested at best. Furthermore the track would never be in as good condition as we are now able to keep it continually, at very low cost.

The tracks in the block just south of Polk street do not contain any special work and were built at the same time (1920) as those described above, and of the same heavy ballasted construction, but without the concrete slab; they carry the same traffic. Ordinarily, due to the special work, track maintenance in the block north of Polk street would have been much higher than in the block just south; actually maintenance of the tracks containing the special work, and laid on a concrete slab, has been less than a quarter of that required in the other block without special work and without a concrete slab. This saving will pay for the concrete slab in a short time.

The effect of this type of track construction on the labor situation seems interesting to the writer. Ordinary section work does not appeal to American born laborers. In recent years we have had to depend upon immigrants for the larger part of it, and the limitation of immigration is bringing about a serious shortage in common labor. Maintenance of track construction on concrete slabs as used in the Chicago Union Station requires only a small proportion of the labor required for ordinary track maintenance, while that which is required is of a higher standard. In that way this type of track construction fits in

Laying Special Work on Concrete Slabs North of Washington Street

well with the tendency of labor to move to work requiring more skill and paying higher wages.

At the average rate which the wire mesh reinforced slab was laid a 10-ft. slab would cost around $20,000 per mile. Where work could proceed more uniformly and larger quantities could be laid without interruption a considerable reduction in that cost would be possible. It is believed that there are many miles of heavy traffic track on trunk lines where the reduction in maintenance costs secured by the construction of such a concrete roadbed would more than offset the additional capital charges. This is particularly true at many stations, yards, turnouts and crossings where maintenance costs of ordinary track are usually excessive. The bad effects of "soft spots" in present roadbeds could largely be overcome by placing a concrete slab beneath the ballast.

LOOKING INTO THE FUTURE—At the time of the Civil War the railroads of the United States handled 1,000,000 tons of revenue freight per year, at the end of the century 1,000,000,000 tons, and today, 2,500,000,000 tons, according to James R. Bibbins, consulting engineer, Washington, D. C., in a paper presented before the American Society of Civil Engineers. If population of 130,000,000 is assummed by 1940, a revenue traffic of nearly 4,000,000,000 tons must be provided for by the railroads. To meet this, at least $10,000,000,000 new capital is needed.

Getting Good Results With Stucco on Frame Buildings

An Outline of the Fundamental Requirements for a High Grade Portland Cement Covering

By A. C. Irwin
Technical Staff, Portland Cement Association, Chicago

THE ANCIENT builder emerging from the primitive condition of supplying only necessary shelter to that advancement in which the artistic or æsthetic side of mankind began to be reflected in his abodes, found stucco adapted to his needs and disproved the prevalent notion that stucco is a new material. The use of stucco is found to have been common with the builders of some of the most ancient structures remaining from the early historic period. Excellent specimens of stucco have been found in the ruins of buildings constructed by the early Egyptians. The Greeks used stucco plaster on the Temple of Apollo at Dellos and on a number of famous buildings of ancient Athens. The Romans used stucco on the first Pantheon and slabs of Roman stucco have been found in the ruins of Pompeii and Herculaneum.

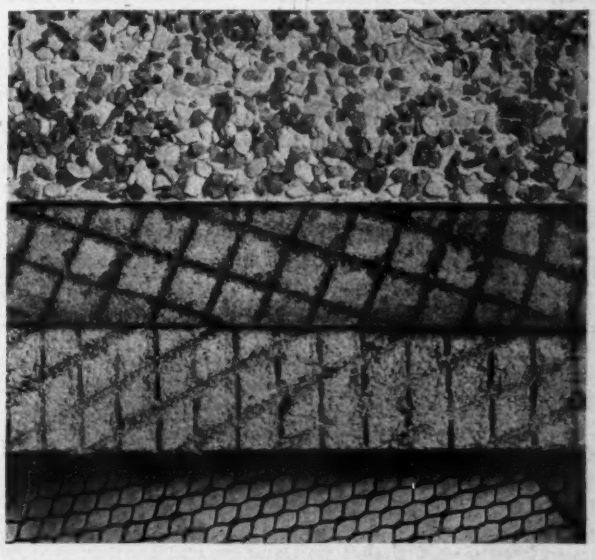
The plaster used by the early Egyptians and Greeks was made of lime and sand or crushed marble. Frequently finely powdered marble was troweled into the surface coat while the mortar was still soft. The plasters used by the Romans were composed largely of sand, lime and volcanic ash taken from deposits near the village of Puzzuoli. This cement is still known as Roman or Puzzolana and many buildings on which this material was used are still standing along the shores of the Mediterranean sea in France. This Puzzolana has many properties of the well known portland cement of today, but is weaker in strength and lacking in that uniformity of quality which is a distinguishing feature of portland cement as manufactured under the guidance of modern controlled processes.

What Is Portland Cement?

Before discussing some of the important things to be observed in the proportioning, application and curing of portland cement stucco, it is worth while to gain a general understanding of the principal compounds in cement and their action in the presence of water. Portland cement as now used in stucco is a product of the careful and scientific combination of materials consisting essentially of lime, silica, alumina and magnesia. In the manufacture of portland cement the amounts of raw materials used are scientifically proportioned and controlled. These materials, in a finely ground condition, are subjected to temperatures of from 2,700 to 3,000 deg. F. Under these conditions certain compounds are formed through interaction of the lime (calcium), silica and alumina. The chemical compound resulting from incipient fusion of the mixture is known as clinker, which is later ground to the fineness of impalpable dust, that is, so fine that at least 78 per cent will pass through the meshes of a sieve having 40,000 openings to the square inch. A sieve with openings so small as this will retain water. It follows that the voids in neat cement compacted and hardened are too small to permit the passage of water.

There are three principal compounds resulting from the process of burning the raw materials for cement in a kiln. Each of these three compounds has a different rate of hardening, that is, combining chemically with water and apparently the properties of each one has a distinct bearing on the way in which portland cement stucco should be applied to secure best results.

One of these compounds "sets up" quickly and is largely responsible for the initial stiffness or pastiness of the mortar. This compound, however, does not contribute materially to the final strength of the stucco. Another of these compounds hardens very slowly and it is due to the influence of this compound that portland cement stucco or concrete increases in strength for many months or even years. The hardening process of this compound, however, does not require any considerable quantity of water, and it is very probable that the amount of moisture supplied by atmospheric conditions is sufficient for the hardening process.



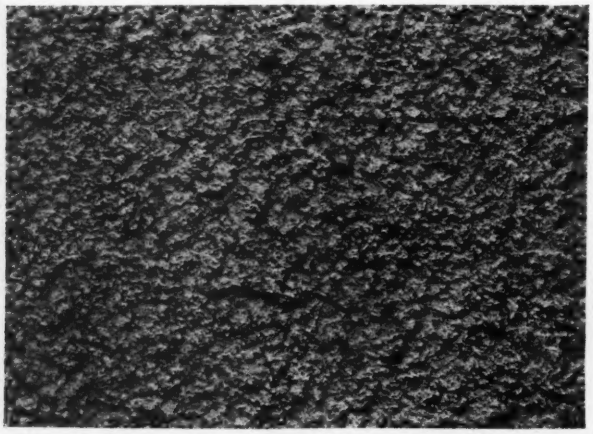
Successive Steps in the Application of Three Course Stucco on Metal Lath

The remaining one of the three principal compounds is responsible, in large part, for the strength attained by portland cement stucco or concrete in the first month of its life. The properties of this compound are, therefore, of utmost importance to the practical man who would understand the fundamental things about portland cement stucco and thus be able to so conduct the work as to obtain best results.

Use Just Enough Water

The artisan should recognize fully the vital effect of water, both in the tempering of the mortar and in curing the finished work. The hardening of portland cement is due to a chemical action between the compounds in the cement, and water. This process of hardening does not take place at once but requires sev-

eral weeks of continuous chemical action before the cement has reached even a large percentage of the strength which it is capable of gaining. It is, therefore, obvious that if, through absorption of the water used in mixing the mortar or through evaporation, the cement dries out within a short time after the application of the stucco, a large part of its possible strength will be lost.



Spatter Dash Finish

It might be assumed from the above that the use of a large quantity of water in the mortar is beneficial. Nothing could be farther from the truth. The ideal quantity of water is that quantity only which will be sufficient to combine completely with those compounds in the cement which take up water in the process of hardening. Excess of water over this ideal amount merely occupies space which, on loss of the water through evaporation or otherwise, will be unoccupied and contribute to the porosity and lack of strength of the stucco. The above discussion of the influence of water leads to the important rule to be observed in practice, viz., use the smallest amount of water practicable in mixing the mortar and keep the finished work wet for ten days or two weeks.

It has been observed that portland cement mortar or concrete contracts when the process of hardening takes place in air, that is, when it is allowed to lose its moisture before complete hydration has taken place. It has also been observed that portland cement mortar or concrete expands when the hardening process takes place under water. If, however, the curing of the mortar takes place under neither the condition of normal exposure nor immersion, the amount of change of volume is reduced to a minimum and this is the ideal result desired. Such condition is supplied to a large extent by sprinkling the finished stucco or otherwise keeping it damp for at least two weeks.

The contraction of portland cement stucco hardening in air can also be removed to a large extent by mixing the ingredients several hours before it is applied, and remixing them just prior to application. This is due to the fact that the initial set or stiffening of the mortar is due largely to one certain compound in the cement as described above. By preparing the mortar several hours before it is to be applied, and then remixing it, the chemical action of this compound is already largely completed and the contraction which would occur from this cause after the stucco is in place is thus prevented. Furthermore, since this compound adds practically nothing to the ultimate strength of the stucco, nothing is lost through the method of remixing. It should be borne in mind, however, that in the process of remixing or retempering, no additional water should be added to the mortar. It should also be borne in mind that the mortar should be remixed before it has set up to such an extent that, by the simple process of remixing without the addition of water, it cannot be brought back to a perfectly plastic condition without lumps or areas of partially hardened cement. Under conditions of normal temperatures on cloudy days, it is usually safe to allow from three to four hours to elapse between the time of mixing of the mortar and its remixing and application.

Reinforcement Prevents Cracking

The expansion or contraction of concrete, due either to the conditions of curing or to differences in temperature, is very greatly affected by reinforcement. Tests show that the presence of 0.8 per cent reinforcement

Stippled Finish

may reduce the amount of contraction to approximately one-third of what it would be without the reinforcement. The beneficial effect, therefore, of a good metal lath or wire mesh as a base for portland cement stucco is obvious. Specifications for this material usually call for the use of 3.4 lbs. of expanded metal per square yard of surface, and this weight of metal would be equivalent to approximately 0.9 per cent of reinforcement.

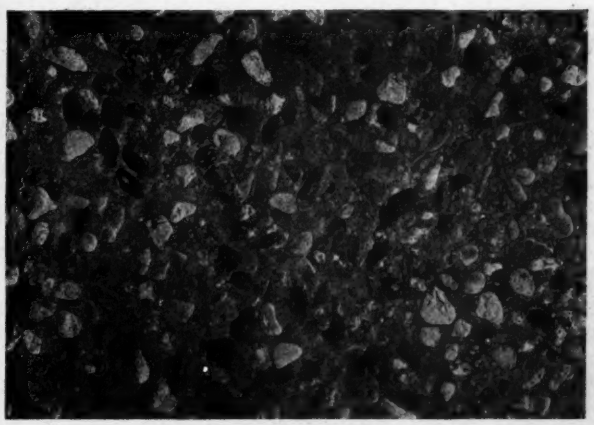
A further very important effect of metal reinforcement is to increase the strength and flexibility of the stucco coat. A surprising degree of flexibility is exhibited by thin concrete slabs reinforced with wire mesh or expanded metal. Deflections of several inches in spans of less than 10 ft. are usually obtained without any noticeable cracking of the concrete. It is evident, therefore, that one of the best safeguards against the cracking of stucco due to vibration of the building in high winds and the changes occurring in the supporting frame through changing moisture content will be taken care of through the ability of the stucco to bend or deflect when it is properly applied over a good metal base. However, in order to gain the full benefit of metal reinforcement, care should be taken by the artisan to fully imbed the metal in the scratch coat. This means that no pains or energy should be spared to push the scratch coat through the meshes of the metal reinforcement so that it will not only "button" through but will imbed the metal. Here again the amount of water used in the mix has an important effect on obtaining full imbedment of the metal lath. A mix that is at a limit of wetness such that it is just possible to make it hang on, will not have sufficient stiffness or pastiness to take pressure from the trowel or float so as to imbed the metal base

fully. The mortar should be used in just as stiff and pasty a condition as it is practicable to work it.

What Proportions to Use

Tests made at the Bureau of Standards, Washington, D. C., indicate that the amount of contraction on mortar hardening in air is roughly proportional to the amount of cement used, that is, the lower the cement content, the smaller the amount of contraction to be overcome by the methods of retempering and wetting the finished work. Therefore, a balance should be struck as between the required strength and the smallest amount of cement that will hold the material in place. The cement content, however, should not be reduced to that which will produce a porous or weak mortar. Experience indicates that a mixture of approximately one part of portland cement to three parts of well graded sand in which coarse particles predominate, is about the right proportion.

The amount of sand and cement used in each batch should always be carefully measured so that the stucco will have uniform proportions throughout. There is a certain advantage in uniformity of proportions to be expected from the use of premixed portland cement stuccos, that is, dry sand and cement mixed together and shipped in bags ready for use. In this way, the proportioning of materials is easily controlled under manufacturing conditions.



Pebble Dash

A very great number of stucco jobs have been done by workmen who are essentially plasterers, that is, accustomed to using the materials and methods for interior plaster finish. They are accustomed to the fatness of lime and are, therefore, prone to embody all of the hydrated lime into the stucco which it will "carry" and thus obtain the familiar plasticity of lime or gypsum plasters. Hydrated lime in amount not to exceed 10 lb. per sack of portland cement may be added, especially for the scratch coat, but this amount should never be exceeded. Some experience with masons, in regard to the fatness of mortar which is usually considered essential to efficient work, has disclosed the fact that the idea that fatness of mortar or stucco is required is largely fanciful. It was found that bricklayers would actually lay up practically the same number of brick with portland cement mortar to which no lime had been added, as they could with mortar to which they had added a large percentage of lime. The same is true to a certain extent with portland cement stucco. The addition of excessive quantities of hydrated lime to the material for the finished coat, will be almost certain to result in a reduction of strength of the stucco and in supplying material which may be dissolved out by the action of rain water. For the scratch coat, this is not so important, because this coat is protected from moisture by the succeeding coats.

The well dispositioned plasterer has a certain pride in the appearance of his handiwork at all stages of its progress. Often this results in excessive trowelling of all the stucco coats to secure what may be considered the appearance of a good job. It is difficult to describe, in a theoretical way, just what happens through excessive trowelling. It is a known fact, however, that excessive trowelling reduces the strength of the mortar. This may be due to the disturbance of the natural arrangement of the particles of the mortar and, of course, the tendency of trowelling is to bring the finer particles, including sand, to the surface, thus destroying the even distribution of cement in the coat. It is also a known fact that mortar thrown against a clean concrete surface and allowed to remain undisturbed, acquires a perfect bond with the underlying concrete, providing the latter is sufficiently moist to prevent it from absorbing the water in the applied mortar that is necessary to the sitting and hardening.

Structural Requirements

The primary object of stucco is to produce an envelop at once attractive and impervious to rain and wind. Stucco is not intended primarily to act as a structural element of the building, and the usual methods of applying it are such that it can lend but little to the stability of the structure. Metal lath attached to furring over sheathing is not directly connected in a rigid manner to the frame work of the building, and therefore, cannot be expected to prevent distortion of the frame work. However, a relatively thick coating of portland cement stucco completely embedding metal lath, attached directly and rigidly to the frame work, will undoubtedly add materially to the stiffness of the structure, but cannot be expected to take the place of bracing, or to completely resist the twisting of the structure in high winds.

Sponge Finish

Summary

The following rules* are given to serve as a guide in securing satisfactory stucco work.

*Complete specification for portland cement stucco on frame and masonry buildings and descriptions of various finishes may be obtained on request of the Portland Cement Association, 111 West Washington Street, Chicago, Ill.

1. Do not use dirty sand or sand that is not properly graded. Not more than five per cent of the sand should pass a 100-mesh screen.

2. Take particular care to see that the sand and cement are thoroughly mixed before water is added. A good rule is to mix the sand and cement for two minutes before adding water and three minutes after the water is added. If possible use a machine mixer.

3. Fix the proportions of cement and sand accurately and do not change them unless there is a change in the grading of the sand. One sack of cement to three cubic feet of sand is recommended.

4. Hydrated lime to the amount of 10 lb. per sack of cement may be added, but this amount should not be exceeded.

5. Use no more water than is absolutely necessary to produce a plastic, workable mix. Remember that excess water in the mix is a source of weakness.

6. Remember that moisture is necessary for the hardening of stucco, therefore, do not apply stucco to a dry wall, but drench the wall thoroughly before stuccoing.

7. Keep down the amount of trowelling and working of the stucco coat to an absolute minimum. Apply water as soon as each coat has set up enough so that it will not wash. Keep all coats wet for several days. After the finish is applied, keep the stucco wet for three weeks if possible.

8. Apply stucco continuously. Don't let it dry at the edges—run the second coat the day after the first coat. Roughen or scratch the first coat for proper bond.

9. Keep the steel trowel off of the stucco surface as much as possible. Use a wood float but use it sparingly.

10. Do not apply the finish coat until previous coats have been cured for at least one week.

11. Provide all belt courses, water tables, sills and other projections with over-hang, steep wash and drip.

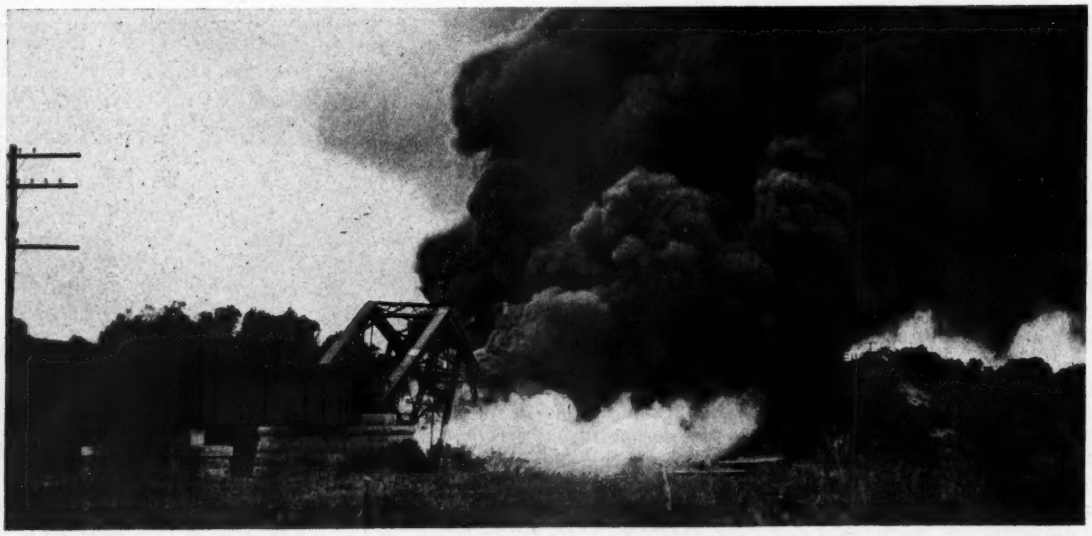
12. For horizontal surfaces where water can collect the base should be of cast concrete at least two inches thick reinforced with wire mesh or steel rods. If a stucco finish is desired this can be placed on top of the concrete base.

13. Do not retemper the mortar by adding water to it. Mortar that has been mixed at frequent intervals without the addition of water may be used.

14. Execute the work in strict accordance with the American Concrete Institute's recommended practice for portland cement stucco.

Derailed Tank Cars Catch Fire and Destroy Two Bridges

THE DERAILMENT of a freight train on or approaching the Cimarron River bridge of the Atchison, Topeka & Santa Fe near Guthrie, Okla., not only wrecked a through truss span of the bridge but resulted in an oil fire which did far more damage to the railroad structure than that caused by the derailment and also destroyed a highway bridge located about 700 ft. downstream from the railway crossing.



The Derailment and Wreck Was Followed by a Terrific Oil Fire

The Cimmaron River bridge of the Santa Fe consisted of two 210-ft. truss spans and four 80-ft. deck girder spans, the truss spans being supported on limestone masonry piers. A car derailed near the north end of the bridge broke one of the end verticals of the north truss span and hit one of the north ends posts of the south truss span, pushing the span off of the pier into the river. The engine and a number of cars at the head of the train passed over the bridge safely but a number of cars in the rear of the derailed car which caused the wreck were precipitated into the river with the south truss span. Most of these cars were oil tank cars, the contents of which, spreading out over the surface of the river and igniting through some means, caused a fire of enormous volume and intensity. This was communicated to the wooden deck of the north truss span and the cars standing on it and not only destroyed them but also caused such injury to the steel

The Oil Fire Was Communicated to a Highway Bridge Downstream from the Santa Fe Structure

work of this span as to necessitate its entire replacement as well as the span wrecked by the derailment. The heat of the fire was so intense as to calcine the limestone of the pier supporting the adjacent ends of the two truss spans to such a depth as to require the entire renewal of this pier above the water line.

But as if this was not enough damage from this accident, the burning oil, floating down stream with the current, set fire to the floor of one of the spans of a four span highway bridge across the river. No means being available either for fighting the fire or for tearing up the floor to produce a fire gap, the fire gradually spread across the deck for the entire length of the bridge, causing some of the spans to collapse and doing such injury to the steel in the others as to necessitate the entire renewal of the superstructure of this bridge.

After the Fire Had Subsided. Wrecked Oil Cars in the Debris of the Fallen Span

Prompt action by the bridge department of the Atchison, Topeka & Santa Fe in securing data for the renewal of the two spans of the railroad bridge and in contracting for their fabrication, insure that the new spans will be in place ready for service by the end of October. The erection of the new structure will be done by company forces.

We are indebted for the above information to A. F. Robinson, bridge engineer, Atchison, Topeka & Santa Fe System, Chicago.

The Tie Plug—One of the Little Things That Count*

A RAILROAD tie properly treated with a suitable preservative will resist decay almost indefinitely, provided it is not neglected after being placed in the track. The spike penetrates the treated wood and reaches into the untreated wood. When it is withdrawn the holes fill with water and the constant filling up and drying out promotes decay at the bottom of the holes. This weakens the tie at the very point where strength is most required, and it is a fair presumption that many broken rails and serious train wrecks can be traced to tie failures, due to rot attacking the wood around the unprotected spike holes.

The proper and only way to prevent these tie failures is to plug every spike hole. This should not only be done when new rails are laid, but it should be done conscientiously in daily maintenance work as well. There are a few, and only a few, railroads in this country that strictly enforce an order to plug every spike hole, and they see that every section crew carries and uses the plugs at all times.

There are many otherwise splendidly managed railroads today that neglect this important detail, and the resulting shortened life of their ties is costing them a large sum annually.

The majority of the large roads order all spike holes plugged, but often the order is not enforced and the matter is soon dropped and forgotten. Section foremen on various railroads throughout the country have been interviewed, and in the great majority of cases on that particular day they had not tie plugs. Either they had forgotten them or the supply at section headquarters was exhausted. Frequently the foreman claims that he puts tie plugs on his requisition but they are not furnished.

When a periodic spasm of economy sweeps over a railroad system—all railroads have these attacks at times—requisitions for supplies are out, and someone who does not appreciate the importance of the plug "blue pencils" the requisition. He saves a few dollars, but for every dollar so saved, many dollars will be spent later to repair the damage caused by this mistaken policy of economy.

The importance of treatment of railroad ties is appreciated by all railroad engineers, but the after-treatment—the intensive use of tie plugs—is too often neglected.

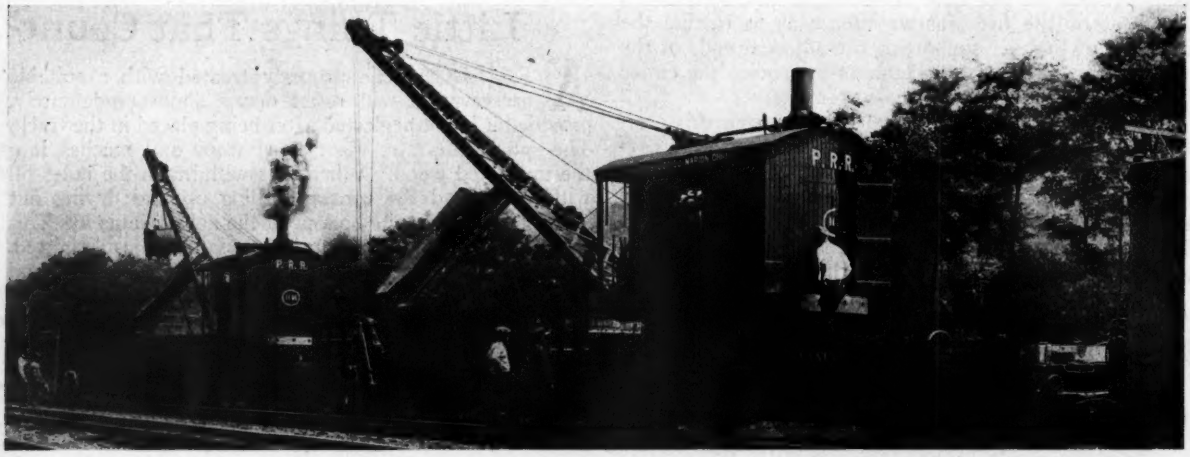
*From Wood Preserving News for August, 1923.

Lowering Costs for Cleaning Ballast*

Various Types of Mechanical Equipment and Methods of Operation Compared and Possibilities Discussed

AMONG THE requirements of stone ballast, which is the ballast in general use under heavy traffic, is that it must be clean in order to perform its necessary function of drainage. Dirty ballast produces rough track on account of pumping in summer and heaving in the winter. To obtain clean ballast it is necessary to screen out the dirt. This is almost universally done by means of hand labor with ballast forks. On account of the enormous expense of this work and the inability to keep up with it under present labor conditions, considerable study has been given to the development of machinery which will not only cut the cost of screening, but will permit an output sufficient to produce clean ballast at a reasonable cost.

The development of such a machine is not at all impossible. The chief obstacle to its achievement is the apparent endeavor to produce a machine at a low cost, by which we mean several thousand dollars. It is thought that an expenditure of $50,000 to $100,000 would result in a machine which would do the work and save enough money to justify the investment.



Ditchers and Clam Shell Buckets Are Recommended Where Large Production Is Necessary

The ideal ballast cleaner should do the following:

(1) Thoroughly clean stone.
(2) Load screened dirt in cars.
(3) Require a minimum of hand labor (no shoveling).
(4) Deposit clean stone where desired.
(5) Clean tie cribs.
(6) Obstruct no more than one track when in use.
(7) Show a very large saving over hand labor.
(8) Cover a large yardage daily.

Such a machine, we understand, is now being worked on by different people.

Probably the first effort to get away from the forking of ballast by hand consisted of a screen onto which the ballast was thrown by hand, to separate the stone from the dirt. This was improved some years ago and the result was the Trench-Zepp ballast screen.

This screen has done some very good work on a number of railroads. The screen is set at an angle and held by supports in the rear, the dirt going through the wire mesh and the stone falling at the foot of the screen. Provision is made for lowering the screen to clear passing trains and with this feature some roads used the screens in the inter-track space, dropping them when trains passed on either side.

The Trench-Zepp machine was tried by many roads and used extensively by the Baltimore & Ohio, but in actual use it showed very little merit over the ordinary hand method of cleaning other than saving stone, which, figuring a 10 per cent loss, amounts to 79 cents per rail length, resulting in a net cost of $2.31 per rail length to clean ballast by this method.

The Pratt mechanical ballast cleaner was an effort to make a machine that would work in the center ditch continuously, without interference with passing trains, and do the work mechanically. An endless chain, carrying three small buckets, was driven by a one-cylinder gasoline engine. The dirty ballast was lifted by these buckets and thrown on a shaking screen. The dirt went through the screen onto a pan where it was shoveled out by hand. The stone passed over the screen to the inter-track space.

On account of the close clearance the buckets could not be turned from side to side, but had to be kept directly in the center, between the tracks. This meant that, in order to cover the entire ditch, one man had to help the dirty ballast into the buckets. The machine travelled forward on a caterpillar tractor, propelled by one man working a lever in the rear. This forward movement was later attached to the engine, but without success, as it was found that the speed forward had to be changed as the material, with which the machine worked, varied. This machine would average six rail lengths per day with five men under favorable conditions. The repairs, however, were heavy on account of the

*An abstract of a report prepared by a special committee of the Metropolitan Track Supervisors' Club and presented at its last regular meeting at the Hotel Martinique, New York City, on August 11. The committee consisted of J. H. Cooper, supervisor, Penna., New York City, chairman; W. E. Pettigrew, assistant division engineer, B. & O., New York City; M. Deniff, supervisor, Erie, Jersey City, N. J.; Ralph Haring, supervisor, L. I., Jamaica, N. Y.; I. D. Talmadge, roadmaster, N. Y., O. & W., Middletown, N. Y.; N. A. Schutz, assistant supervisor, C. of N. E., Poughkeepsie, N. Y.; P A Savage, assistant engineer, N Y., N. H. & H., New Haven, Conn.; W. A. Clark, supervisor, P. & R., Trenton Junction, N. J.; M. Griffin, supervisor, C. R. R. of N. J., Jersey City, N. J.; A. M. Clough, supervisor, N. Y. C., Batavia, N. Y.; F. T. Fish, supervisor, Penna., Bordentown, N. J., and C. J. Coon, supervisor, N. Y. C., New York City.

severe duty required of such a comparatively light machine, which, including stone saved, showed a net cost of $2.34 per rail length.

Cleaning by Ditcher and Clam Shell Buckets

The cleaning of ballast with a ditcher and clam shell is being done by several railroads. The dirty ballast is lifted out of the center ditch with a clam shell and dropped on a movable screen which is mounted on a gondola car. The dirt goes through the screen and the stone is directed through a steel chute back into the inter-track space. The clam shell varies in size from three-quarter yard to one yard, depending upon the width of the space between tracks and to about one foot below the bottom of the ties. At the same time it breaks up the area between tracks to a depth considerably below this. The screen is made of ¼-in. rods with a 1½-in. mesh, and is set at a slope of about 45 deg. It is 9 ft. wide on top and tapers to about 2 ft. at the bottom.

Although this machine will not do as thorough work as can be done by hand, it will cover ground much more rapidly and is helping to meet the present labor shortage by relieving track gangs of much important work. Usually two ditchers are operated in one train, each working with a screen on a gondola car, although as many as three ditchers have been worked as one train unit. With a two-ditcher train the average day's work has been found to be about 55 rail lengths of center ditch. The cost of this work, for a nine-hour day, is as follows:

Engine crew	$ 16.45
Train crew	17.96
Laborers (4)	12.60
Foreman	5.27
Ditcher engineers (2)	9.31
Ditcher firemen (2)	6.54
Train expenses (9 hr. @ $6.50)	58.50
Ditcher expenses	20.00
Total	$146.63

This is equivalent to a cost of $2.65 per rail length, which, including ballast saved, is reduced to $1.85 per rail length. Where the ballast is very dirty as much as a 100,000-lb. gondola full of dirt has been taken out by one ditcher in a day. In some places this dirt cannot be disposed of over the bank and when this work is done by hand the dirt must be loaded. With the ditcher this work of loading the refuse in a car is included in the above costs. A more detailed description of this method of cleaning ballast may be found in the *Railway Maintenance Engineer* for March, 1922, page 98 and in *Railway Engineering and Maintenance* for March, 1923, page 92.

Operation of the Harris-Muff Machine

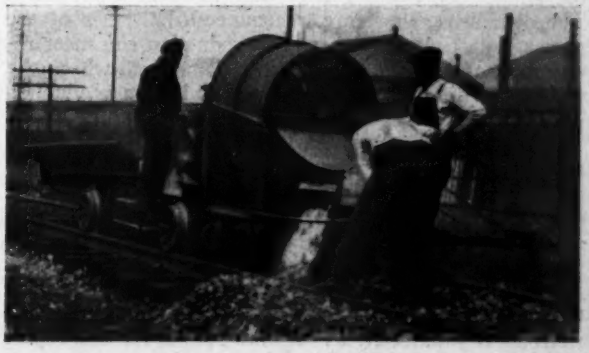
The Harris-Muff power ballast cleaner consists of a moving belt in a trough, into which the dirty ballast is shovelled. This ballast is carried to a circular screen which separates the dirt from stone. The stone is sent through a chute to the track, either center or between tracks, and the dirt is carried on a moving belt and deposited clear of the ballast shoulder. The entire mechanism is operated by a gasoline engine, which also serves to propel the ballast cleaner at a rate of about 15 miles per hour when going to or from work or clearing trains. Skids are also provided, which enable the machine to be set off the track in about eight minutes.

The customary operation is to skeletonize the track in advance of the machine. This can be done while the machine is clearing for trains so that no time is lost on that account. The ballast that has been taken out of the cribs and the stone in the inter-track space are shovelled into the machine where it is screened and returned to the track.

The proper number of men to work this machine is about 15 and the cost will run about $2.50 per rail length. Including the ballast saved, this figure is reduced to $1.71 per rail length. This figure is based on 16 rail lengths of track cleaned in a nine-hour day and is arrived at as follows:

15	Laborers (9 hr. each)	@ $3.60	$54.00
1	Foreman	5.00	5.00
6	gal. gasoline	.23	1.38
¼	qt. oil	.23	.06
1	lb. grease	.15	.15
	Total cost to clean 16 rail lengths		$60.59
	Cost per rail length		3.75

This does not include the cost to skeletonize the track but includes one six-foot space and one shoulder. As, for purposes of comparison, we desire to consider the cost to clean the six-foot space alone, and as two-thirds of the operating force is used to shovel stone from the six-foot space into the machine, we take two-thirds of $3.75, or $2.50 as the cost to clean a six-foot width per rail length. The stone saved per rail length (10 per cent)



The Harris-Muff Power Ballast Machine Is Recommended for Moderate Production

is valued at 79 cents. This brings the cost to clean the six-foot strip per rail length to $1.71.

As the dirty ballast is shoveled onto the moving belt by men directly opposite each other, attention is called to the wooden guard placed directly over the belt, which requires all stone to fall on the belt and prevents it from reaching the men on the opposite side of the track. This machine could be improved by extending the receiving belt to clear the body of the machine, which would permit the belt to be lowered so that the men would not have to lift the ballast so high. This would increase production. Some mechanical means for feeding the machine should be devised to eliminate hand labor. The capacity of the machine is far in excess of what hand labor can keep up with. This machine is the nearest approach thus far to a purely ballast cleaning tool.

Some interest has been shown lately in the possibility of cleaning ballast by vacuum suction, and plans for such a machine have been drawn up. Such a machine could lift dirt and stone with a separating process. There are no doubt possibilities along this line if the necessary money can be secured.

It is thought that the cleaning of cribs can be done cheaply, and as quickly, by hand forking as by first skeletonizing track and then rehandling stone to pass it through a machine, for the reason that, with the usual hand method, a few cribs are first cleaned out in advance and as ballast is forked out of the dirty cribs it is shaken, and clean stone thrown directly into the empty cribs with one han-

dling. In skeletonizing the track and then passing dirty ballast through a machine, two handlings are necessary. With present machine methods we therefore eliminate the cleaning of cribs except by hand and show below the cost per rail length to clean a six-foot width by the various methods in use at the present time; with tracks at 13 ft. centers:

Method	Depth Below Ties	Cost per Rail Length
Trench-Zepp	6 in.	$2.31
Pratt	3 in.	2.34
Clam Shell (two ditchers in one train)	12 in.	1.86
Power Ballast Cleaner	6 in.	1.71
Hand	6 in.	3.10

For purposes of comparison the different depths attained in the six-foot areas have been disregarded but the results obtained, for obvious reasons, favor the method reaching the greatest depth.

The committee concluded that the power ballast cleaner is the most economical of the present known methods, with the clam shells and gondola screens second in cost. The chief objection to the power ballast cleaner, as compared with the clam shell and screen, is that the former will not cover enough ground per day to keep up with the amount of cleaning necessary to make clean track. The committee, therefore, recommended the use of the power ballast cleaner where its production can meet requirements, and the use of the clam shell where the amount of dirty track is excessive and large production is necessary.

The committee emphasized, however, that none of the machines described answer the requirements fully and reiterated the belief that a proper machine can and will be developed when a sufficient expenditure is made.

Results of Test on Erie Railroad

As an appendix the committee presented a report of the performance of a power ballast cleaner on the Erie railroad at Elmira, N. Y. As the figures for this report include the cost of a skeletonizing gang it cannot be compared with the figures already quoted, except in a general way. It, however, is interesting as showing the savings effected by the use of this machine.

In an eight-hour day the fuel consumption approximated 10 gal. of gasoline and two quarts of oil. The stone to be cleaned was first cribbed from the track to the shoulder by a force of men well in advance of the machine, and then shovelled into a long trough through which a belt operates carrying the stone to the revolving screen. The cleaned stone was returned to the track at any point desired by means of a metal chute at the rear of the machine which can be shifted so as to place the stone either between the rails or outside the rail to the end of the ties. The dirt was delivered onto a moving belt which placed it on the shoulder at the seven-foot line.

The force required for efficient operation of the machine depended on local conditions. At Elmira the organization after several changes was as follows:

1 foreman.
10 men cribbing out in advance of the machine.
7 men placing the stone in the machine; 3 on the outside shoulder and 4 in the space between tracks.
1 man disposing of the dirt at the seven-foot line.
1 assistant foreman in charge of the machine and operating the stone chute.
1 machine operator.
1 flagman.

This organization was able to clean an average of 96 ft. of track per hour. At the location where the machine was used the traffic is quite dense, an average of 95 trains being operated over the two tracks in 24 hours. The machine was delayed by passing trains 22 per cent of the total time it was in use. The average cost per lineal foot of track cleaned was 15 cents, the average cost per cu. yd. of stone cleaned being 42 cents. This effected a saving in favor of the machine of about $700 per mile of track and an approximate saving of 25 per cent in stone, as there was no waste of stone is cleaning by this method.

When there are sufficient men, the work should be arranged so that the tie renewals are made while track is open, since by doing this a considerable saving can be effected in the cost of renewals. At Elmira the ties were renewed after the ballast had been cleaned, at which time the track was given a two-inch raise, surfaced, lined and dressed and had the appearance of newly stone ballasted track. The work was carried on under W. J. Flynn, supervisor of track, with N. Manberg, section foreman, in direct charge.

Unusual Precautions Taken With Harding Funeral Train

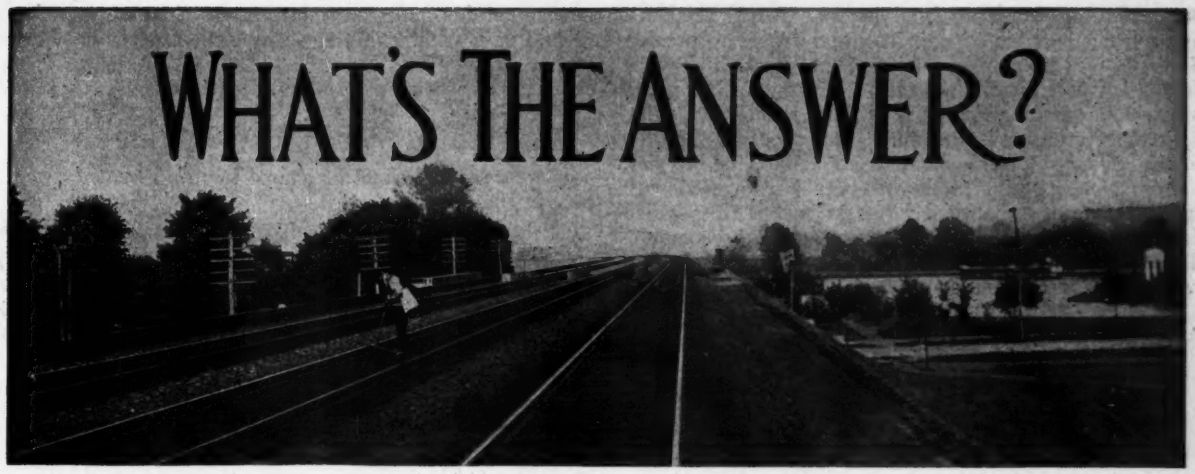
IT IS doubtful is more complete measures have ever been taken to safeguard a train than were taken in the operation of the special train conveying the body of President Harding from San Francisco, Cal., to Washington early in August.

On all four of the roads over whose lines the special ran, the Southern Pacific, the Union Pacific, the Chicago & North Western and the Baltimore & Ohio, nothing was left undone to avert any possibility of accident. The precautionary steps taken by the Chicago & North Western, while possibly a little more complete than those on the other roads, were identical in the main with those taken by them.

A pilot train was operated 15 min. in advance of the funeral train. This pilot train consisted of a locomotive, a steel baggage car and a business car.

All facing point switches on the eastbound main line outside the limits of interlocking plants were locked and spiked previous to the passage of the pilot train and remained spiked until the funeral train had passed. These switches were inspected by officers on a motor car prior to the arrival of the pilot train. Many highway crossings along the line were guarded by special watchmen during the passage of the pilot train and the funeral train, sectionmen being stationed at all crossings between Clinton and West Chicago. These crossings were closed 10 min. after the passage of the pilot train and not opened until the funeral train had passed.

All eastbound freight trains and all switch engines and transfer trains cleared the main line one hour in advance of the scheduled arrival time of the pilot train and remained clear until the funeral train had passed. The conductors of these trains advised the train dispatchers as soon as they were in the clear to assist them in keeping track of trains on the main line in advance of the two specials. Local eastbound passenger trains conflicting with the schedule of the special also cleared the main line a considerable time prior to the pilot train's arrival, so that an absolutely clear track was assured at all times. Westbound passenger trains were instructed to slow down to six miles an hour on meeting the pilot train and continue at that speed until the funeral train had been met and passed. These trains were usually halted by the crowds, however. All westbound freight trains came to a complete stop on meeting the pilot train, while the train crews inspected the north side of their trains, which was adjacent to the track occupied by the special, with a view to seeing that there was no danger from swinging doors.



This department is an open forum for the discussion of practical problems of engineering and maintenance of way. Readers are invited to send in any questions which arise in their work in the maintenance of tracks, bridges, buildings and water service. *Railway Engineering and Maintenance* also invites the co-operation of its readers in answering any of the questions listed below.

Questions to be answered in the November Issue.

(1) Is it advisable to set certain days of the week or month for section gangs to pick up scrap and debris?

(2) What are the relative merits of saw tooth and monitor roofs for railway buildings?

(3) Is it good practice to splice foundation piles? How should the splices be made?

(4) Can explosives be used effectively in a drilled well to increase the flow? Under what conditions and how should they be used?

(5) Is it advisable to have section foremen ride over their sections on locomotives or trains to determine the riding qualities of the track?

(6) To what extent is it practical to equip railway buildings with weather strips or storm windows?

(7) What is the cause of hair cracks in concrete? How may they be prevented? Are they a cause for anxiety?

(8) What is the difference between gravity and pressure filters and what considerations determine which should be selected?

Anchoring Frame Bents on Bed Rock

Where a trestle must be supported on exposed bed rock so as to preclude the use of pile bents, how should the frame bents be anchored to hold them in place?

First Answer

Where a trestle must be supported on exposed bed rock so as to preclude the use of pile bents, the method of anchoring the frame bents to hold them in place will depend somewhat on local conditions. Assuming that the trestle will be subject to a heavy flow of water underneath, the anchorage should be positive and strong.

Probably the best way to provide for such anchorage is to construct a small concrete pier on the rock under each bent. Anchor bolts should be imbedded in the concrete and extended up through the timber sill. The concrete should be anchored to the rock by drilling holes in the rock and grouting in steel bars, which should extend up into the concrete pier. The sway braces on each bent should be bolted to the timber sill so that the whole bent will be firmly anchored to the bed rock. In case of a high trestle where the posts have considerable spread it will be more economical to build concrete pedestals under the posts than to build piers extending entirely across the bent.

The timber sills can be omitted if desired and the timber posts placed directly on the concrete. In this case iron straps must be imbedded in the concrete and extended up along the sides of the posts and bolted to the posts. Also timber sash braces should be bolted across the bottom of the bents just over the pedestals.

C. S. HERITAGE,
Bridge Engineer, Kansas City Southern, Kansas City, Mo.

Second Answer

Where the conditions described occur, the rock surface is usually too uneven to permit the placing of a sill directly on the rock and the leveling off of the rock surface by means of wooden blocking for the sill will not afford good results. The actual detail arrangement to be followed will depend to some extent upon local conditions, the amount of water and current in the stream, and drift carried during high water periods, but in general, I consider it good practice in these cases to build concrete pedestals two feet square on top, each pedestal to be located directly below the posts in the frame bent. Where the rock surface is uneven and not subject to disintegration, the concrete will usually give sufficient bond to the rock. Shale should be excavated to a satisfactory depth before placing the concrete pedestals. The anchor bolts in the center of the pedestals should terminate a little below the top of the sill and the sill should be counterbored for the nuts and washers.

Where a large quantity of water and drift are carried by the stream, individual pedestals are not desirable, but in their place a small low concrete pier two feet wide on top and about two feet longer than the sill gives a desirable construction. With this arrangement the anchor bolts holding the sill may be located so as to clear the

posts. The top surface of the concrete should be sloped away from the edge of the sill slightly so as to provide drainage for the timber. In extreme cases, it may be found desirable to drill into the rock at the upstream end of the concrete pier, and place a heavy anchor rod, using a fox bolt, grouting it into the rock and bending the top of the anchor rod inside of the concrete body of the pier.

For anchoring sills to the concrete I have used with success some of the special forms of anchor bolts which fasten into a helical spring insert placed in the concrete. These bolts can be turned out of the concrete and again replaced, thus facilitating renewal of the sills.

A. B. SCOWDEN,
Assistant Engineer Bridges, Baltimore & Ohio, Cincinnati, O.

Preventing Leakage in Water Tanks

To what extent is it practicable to prevent wooden tanks from leaking? What precautions are necessary?

First Answer

The best way to keep wooden water tanks from leaking, aside from keeping the hoops tight, is to keep the tanks full of water at all times, or at least keep them full enough to keep the staves saturated with water. While I realize that this is difficult to do in many cases and depends greatly upon the supply and consumption of water, if it is possible to fill the tanks frequently enough so that the staves will be kept from drying out, leaking is not only prevented but a safer condition prevails.

We have a standard practice of removing the hoops for inspection, cleaning, and painting, once every two years. This practice is followed more for the purpose of safety than anything else, for the reason that we use a flat hoop which renders inspection difficult unless the hoops are removed.

We have not adopted any particular method of preventing wooden tanks from leaking, such as calking, etc. If tanks are kept well painted and the hoops gone over at reasonable intervals, much of the leaking can be eliminated.

F. A. BENZ,
Division Engineer, Buffalo, Rochester & Pittsburgh, East Salamanca, N. Y.

Second Answer

There is no reason why wooden tanks properly constructed and properly maintained should leak. In the construction of a wooden water tank it is important first to secure a proper timber. This does not necessarily require timber of the highest grade, but rather that the timber should be well seasoned and framed. Uniformity in framing is of the first importance in tank construction. Where treated timber is used it should also be well treated.

In the erection of the tank, particular care should be exercised to maintain the proper circle, avoiding flat sides. It is also essential that the tanks shall have the exact number of staves to fill the circle—no more and no less. The planks forming the floor should be properly spaced to permit drawing up the hoops to the proper tension. After the hoops are once tightened they should not be disturbed. Under no circumstances should an attempt be made to stop leaks by pulling up the hoops.

A roof is important in keeping a wooden tank tight, from the fact that it preserves the shape of the tank and reduces the strain on the staves and bottom when the tank is filled and emptied. It also prevents the drying out of the staves at the top to a certain extent when the tank is partially empty. To prevent leakage of the tank through shrinking of the staves the tank should be filled to capacity at least once every day although it is not uncommon for tank staves to remain without water for several days without leakage where the tank is provided with a roof.

W. B. BRYANT,
Water Service Inspector, Illinois Central, Chicago.

Treated Wood for Tie Plugs

What advantage is to be gained by using treated wood for tie plugs?

First Answer

Tie plugs are usually made from scrap lumber of inferior woods and when used untreated will decay in a very few years. In a decaying condition, they do not serve the purpose for which they are intended and are quite likely to infect and thus reduce the life of the tie.

The greatest advantage of treated (creosoted) tie plugs is the assurance that they will give service as long as the tie is in use without danger of decay and infection of the tie. The slight additional cost of creosoted tie plugs should justify their use even in untreated ties.

C. F. FORD,
Supervisor, Tie & Timber department, Chicago, Rock Island & Pacific, Chicago.

Second Answer

Treated wood for tie plugs should be advantageous for the same reason that treated timber is—that of preventing rot. It is even more desirable for tie plugs to be treated on account of the importance of preserving the wood adjoining the spikes so as to cause them to hold firmly, thus retarding what is termed "spike killing" of the tie, caused from excessive or too frequent re-driving of the spikes. However, it is a question whether any advantage is to be gained by treating wood for tie plugs where used in untreated ties, my opinion being that untreated tie plugs will last throughout the life of such ties.

J. J. HESS,
General Roadmaster, Great Northern, Seattle, Wash.

Triplex Pumps for Railway Service

Under what conditions is the triplex type of pump to be recommended for railway service?

First Answer

There are definite rules by which to determine the selection of a pump with assurance that it is the best for the particular requirements. Each case has its peculiar twists and turns, and any recommendation must be based upon a careful study of the particular problem. Of the several factors which enter into the problem of selection, the most important is "getting the water into the pump." With the suction requirements met, the problem on the discharge side is easily worked out, and the problem becomes one of recommending the type that will do the work most efficiently. The centrifugal pump has made rapid strides within the past few years, and because of its low first cost and its compactness, its use is certain to increase. Nevertheless, the triplex type of pump remains preeminent in several fields of service.

This type of pump is well suited where the water is too low to be reached by suction from the surface as in deep open wells. The vertical triplex is also adapted to cased wells where it is well suited to operate on suction lifts up to and including 22 ft. It should be noted, however, that where the pump takes its suction from a battery of wells, a vacuum pump should be installed in the line.

The recommendation of the Hydraulic Society applying to centrifugal pumps is that "all guarantees unless specified should be based upon handling clear fresh water at a temperature of not over 85 deg. Fah., and a total

dynamic suction lift of not over 15 feet at sea level." As the practical suction lift decreases about a foot for each quarter mile of altitude, the importance of the above is quite evident. As the practical suction lift at an elevation of one mile above the sea level is 17 ft. for the triplex and only 10 ft. for the centrifugal, it is seen that the triplex pump has an advantage over the centrifugal pump where this element is a governing factor in the design of the plant.

If the water is taken from a river or lake which may fluctuate considerably, the triplex is the more reliable type. The triplex, being of the displacement type, will deliver a constant supply. On the other hand, the capacity and horse power of the centrifugal will change, depending upon the characteristics of the impeller. This means a larger driving unit for the high water, decreased capacity and inefficient operation for the low water. The plunger type of pump also maintains its supremacy for moderate pumping units of high heads—heads of 150 ft. and upwards. Its efficiency is high, ranging from 60 to 80 per cent on pumps of 100 gal. per in. and downwards.

While the above considerations apply to these problems in general, it should be borne in mind that each problem must stand on its own "feet." H. L. DAVIS,

The Goulds Manufacturing Co., Chicago, Ill.

Second Answer

The triplex pump was extensively used for many years but the recent development of the centrifugal pump has resulted in its supplanting the triplex pump to a great extent. Both types are applicable to oil engine or motor drive, but the low first cost and simplicity of the centrifugal pump makes it more desirable for most installations.

There are, of course, conditions where the triplex pump may be better adapted to conditions than the centrifugal pump. For example, where deep pits are used and the pump is placed in the bottom of the pit, it is often undesirable to place a power unit in the pit with the pump on account of the liability of the pit flooding or for other reasons. It is sometimes difficult to secure the proper angle for a belt drive with these deep pits except at prohibitive expense. The triplex pump offers a very satisfactory alternative in cases of this kind, as the pump may be placed in a pit of any depth and extended rods used, setting the power head above the pit and using a direct connection between the head and the power unit or a horizontal belt drive. Vertical drives are unsatisfactory in almost every case. The triplex is also well adapted to conditions of widely varying pumping heads. Triplex pumps in the smaller sizes have proved very satisfactory as chemical feed pumps in connection with water treating plants and are widely used for this purpose.

C. R. KNOWLES,

Superintendent Water Service, Illinois Central, Chicago.

Section Gangs vs. Extra Gangs for Surfacing Track

What are the relative advantages of surfacing track out of face with enlarged section gangs and with extra gangs?

First Answer

The relative advantages of surfacing track out of face with enlarged section gangs and with extra gangs, depend to a great extent upon the amount the track is to be raised. It also depends upon whether the work of tie renewing, gaging and lining is being carried on at the same time. It is the practice on many roads that maintain their track to high standards to renew and space the ties when surfacing track out of face, and to fill in and dress the track and leave it in first class condition, completing the work each day.

If the track is to be raised more than one inch, it should be done under the protection of a flag. This necessitates the stopping or slowing down of trains and as it is expensive to delay trains, such delays should be reduced to a minimum. This can best be done by using extra gangs. Also, more track is raised before it is necessary to close the work for trains when large gangs are employed than when only a few section men are engaged on the work. The same applies to any work which interferes with the scheduled speeds of trains.

There is another advantage in using extra gangs. That it, it is not necessary to change the men from one job to another. Each man can be assigned to do a certain portion of the work and he becomes more efficient than if he is changed from one job to another frequently during the day. The work can also be carried on more systematically and, therefore, more economically.

J. W. POWERS,

Supervisor, New York Central, Rochester, N. Y.

Second Answer

The chief requirement when maintaining track by surfacing out of face is to have thorough and uniform tamping and for that reason section gangs of from 16 to 20 men are preferable to extra gangs. Sections gangs of this size will do better tamping than larger gangs and will not have as many runoffs as gangs with less men. Where section gangs cannot be recruited to this size, gangs can be doubled up to good advantage by using motor cars.

J. B. MARTIN,

Supervisor, New York Central, Elkhart, Ind.

Third Answer

More pains are taken when section gangs raise track out of face than where it is done by extra gangs. The work is done in a more thorough manner because of better supervision and because the section foreman knows that he is going to remain where the work is being done and that the nature and quality of the work will have much to do with how well he is going to be able to get along and compare with adjoining sections. The extra gang foreman and men do not have the same personal interest, as a result of which it goes without saying that in spite of all that can be done to prevent it, the work is slighted. In view of this, extra gangs should only be employed where enough section men cannot be secured to increase the size of the section gangs.

J. J. HESS,

General Roadmaster, Great Northern, Seattle, Wash.

Fourth Answer

The advantages of surfacing track out of face with extra gangs in preference to enlarged section gangs are as follows: (1) The foreman of an extra gang, in most cases, is trained for that class of work, and being continuously in practice, he can tell at a glance how high a raise the material on hand will allow; (2) exclusive of wrecks, etc., the extra gang stays with the job until it is finished; (3) the extra gang foreman has nothing else on his mind but the work he is detailed to do. He generally has an assistant foreman either to raise the track or to supervise the tamping.

The disadvantages with enlarged section gangs are as follows: (1) Eight out of ten section foremen have never surfaced track out of face to the spot board, and those that have done so in years gone by are too much out of practice to make a good job of it; (2) section foremen generally have many other duties to perform in

work where only a few men are required; (3) if a section foreman is surfacing track out of face, the balance of his section is neglected. Notwithstanding the fact that a section foreman when surfacing his section would probably do his best and see to the tamping, etc., the relative merits when analyzed from practical points of view are to the advantage of extra gang. F. A. ELESCKE,

Foreman, Southern Pacific, Niles, Calif.

Placing Rip Rap

When should rip rap be placed by hand rather than dumped?

First Answer

Rip rap should be placed by hand where used for protection. Rip rap dumped is not of much value for protection. The best results are obtained by starting the rip rap on a good foundation below the bed of the stream. It may not be practical or desirable in all cases to excavate below the water to get a solid foundation, in which case dumping the rip rap may be warranted, but it is not a reliable protection when so placed.

G. J. BELL,

District Engineer, Atchison, Topeka & Santa Fe, Topeka, Kans.

Second Answer

Rip rap should be placed by hand for places subjected to overflow where there is not much current, for spillways and for approaches to culverts, for protection against wave-wash, and for all waterways where drains are established. Loose rock is preferred where the current is swift, the loose rock acting to prevent disturbance of the earth embankment. Loose rock is also better where blind drains are desired, or where it is desired to allow the water to seep through. It is also preferable where it is desired to reinforce the toe of embankments, and for filling cribbing. J. J. HESS,

General Roadmaster, Great Northern, Seattle, Wash.

Fender Girders for Truss Spans

Why are not horizontal fender girders provided in through truss spans to protect the web members from derailed cars?

First Answer

Horizontal fender girders are seldom used in truss spans. If a decision is reached to use horizontal fender girders, then a decision must be reached with regard to the forces to which such girders will be subjected and for which they will be designed. If a more or less rational design for the girders themselves is made, the next question to be decided is not only the strength of their connections, but the additional strength that must be provided in the web members of the truss, in order that these members may resist in bending the horizontal forces transmitted to them by the fender girders.

Fender girders add to the cost of the structure not only by the amount of additional weight of the fender girders themselves, but also the additional weight of material required in the main truss sections to carry these girders. Exclusive of the increase in the material in the main web members required to resist bending, the additional material in the main truss sections will probably not increase the unit cost, but certainly the material in the fender girders will. This is due to the difficult shopwork, which increases the cost of the structure.

Neglecting the question of increased unit cost, however, calculations have been made for a single-track 300-ft. truss span as follows: If two lines of horizontal fender or skid girders are placed on each side, these girders will weigh approximately 180 lb. per lin. ft., or a total of 720 lb. per lin. ft. of bridge. The structure, designed for or skid girders are placed on each side, these girders will weigh approximately 4,300 lb. per lin. ft. The total uniform load, that is, dead load, live load and impact, for such a bridge, is approximately 12,500 lb. per lin. ft. Skid girders weighing 720 lb. per ft. of bridge thus increase the total load for which the structure must be designed approximately six per cent. This, added to the weight of the girders themselves, will increase the weight of the span perhaps 1,000 lb. per ft. Such an increase in weight is certainly large and expensive and of doubtful economy.

The use of horizontal fender girders would seem to imply, although it is frequently overlooked, that the floor structure is such as to support moving loads in any position, whether or not on the rails as intended. The addition of horizontal fender girders will also probably induce secondary stresses in the structure.

The track structure, that is, the ties, rails and rail fastenings, is in better physical condition on a bridge than on an ordinary roadbed. All bridges are or should be provided with both inner and outer guard rails. On large and important structures, as a matter of ordinary precaution, regardless of the strength or capacity of such structures, all trains should be operated at such a speed that they are under the control of the engineman. As an approximation, it may be considered that there is one bridge per mile of track, having an average length of 120 feet. The bridge therefore, occupies only about two per cent of the total distance on our railroads in which derailments can occur.

The use of skid girders will not prevent end posts being struck by equipment which has derailed on the approaches to the bridge. Further it is doubtful whether skid girders will function if derailed equipment strikes directly against the web members. In this connection, it is essential that the skid girders themselves should be spliced in a satisfactory manner over and around the web members. Many through truss bridges have been in service from 30 to 40 years or more. Undoubtedly, in that time derailments have occurred, although the bridges have not been seriously damaged. In practically all cases where bridges have been damaged by derailment, the derailment has occurred on the approach to the bridge, resulting first in damage to the important end post of the structure.

For the above reasons, therefore, that is, the experience with through bridges which have been in service for many years, the fact that the length of bridge per mile of track is a very small percentage, that the track structure on a bridge is better than on ordinary roadbed, and that it is protected by inner and outer guard rails, and that traffic is operated at a speed within the control, also the excessive cost of providing skid girders, and finally the doubt as to whether they would actually perform the service for which they are intended, it would appear that the use of horizontal fender girders is not justified.

P. G. LANG,

Engineer of Bridges, Baltimore & Ohio, Baltimore, Md.

Second Answer

We have never adopted the use of fender girders on our truss spans for the reason that we have not felt it necessary. It is true that once in a great while members become damaged, but not to any great extent. It is very rarely that a derailment takes place on a truss bridge. The cars are usually derailed before they reach the structure, and if any damage is done at all, it is done to the

end posts, and in that case, the fender girder would not come into play.

In my twenty years' of experience with the maintenance of bridges, I have known of only two accidents where truss bridges were struck by derailed cars, and in each of those cases the car was derailed before it struck the bridge. I have known of two cases also where derailed cars did damage to web members of the truss, but this damage was slight in comparison with the damage caused in the other two cases mentioned. There are more members damaged by the loads in the cars becoming shifted and some of the material projected and striking the web members, but this seldom results in anything very disastrous and occurs at verious points above the top of the rail.

It is a question just where to put the protecting girder. My opinion is that more and better results can be obtained with less money by placing a substantial inner guard rail on these bridges to keep the trucks of derailed cars in line.

I. L. SIMMONS,
Bridge Engineer, Chicago, Rock Island & Pacific, Chicago.

The Effects of Seepage Through Concrete

What objections are there to the seepage of water through concrete, other than the danger of frost action?

First Answer

Concrete built in the usual manner, with reasonable care in proportioning, mixing and depositing, ordinarily proves satisfactory if water is prevented from entering or passing through it. With the best of care in building the concrete, there will be porous spots, season cracks, joints, etc., where water can enter, and if no precautions are taken against this, such concrete will, in the places where the water passes through, slowly but surely disintegrate and finally cause failure, irrespective of the action and danger from frost.

The rapidity and extent of the damage done by water passing through concrete depends on the degree of purity of the water. Drainage from streets, leakage from sewers and drainage from railroad tracks, containing sulphur or other impurities, hastens the destruction. The water seems to affect the hydrated cement, and to destroy its binding qualities, causing the concrete to become brittle and soft and eventually destroying it.

F. E. SCHALL,
Bridge Engineer, Lehigh Valley, Bethlehem, Pa.

Second Answer

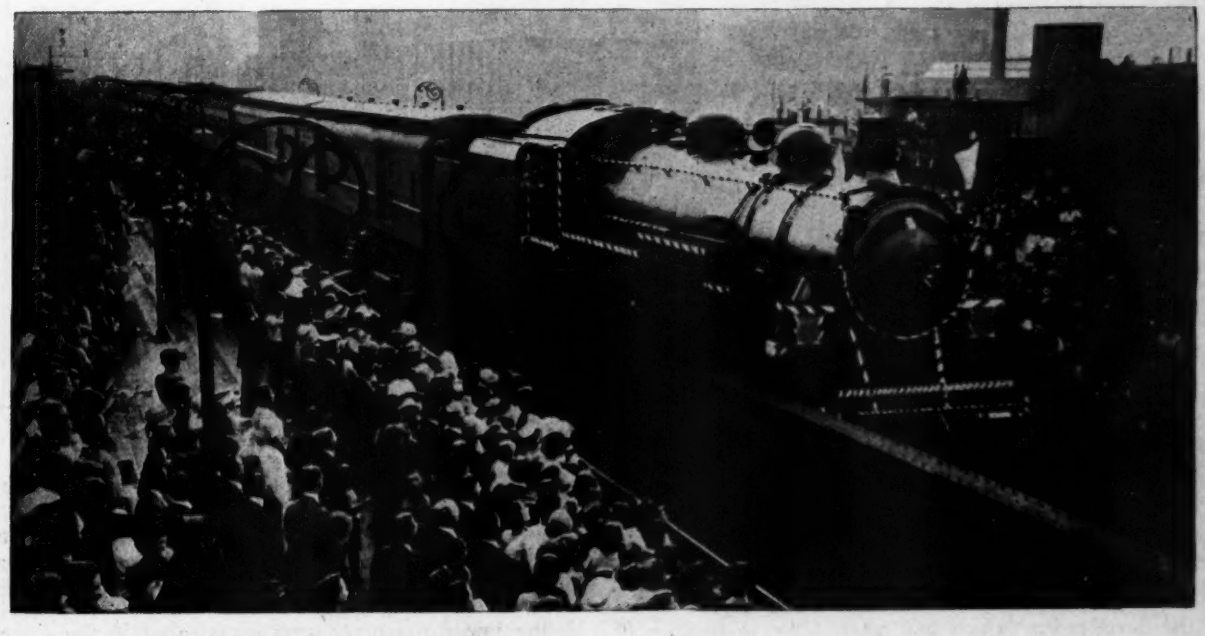
The greatest objection to the seepage of water through concrete is that such seepage is proof of very weak concrete or a very porous concrete, either of which is very objectionable in railroad structures. A grade of concrete that will permit seepage of water will show disintegration in a comparatively short time. Water seepage through expansion joints or construction joints is also very objectionable. I have observed numerous cases of such seepage where the concrete surfaces showed disintegration in the vicinity of the joints. A further objection to the seepage of water through the joints is the discolorations that are caused thereby on the exposed surfaces.

Seepage of water will eventually break down the structure of the concrete and cause deterioration. I have always inclined to Professor Abrams' theory that the disintegration of the concrete structures at the ground line may be explained by the alternate wetting of porous concrete at that point and its drying out.

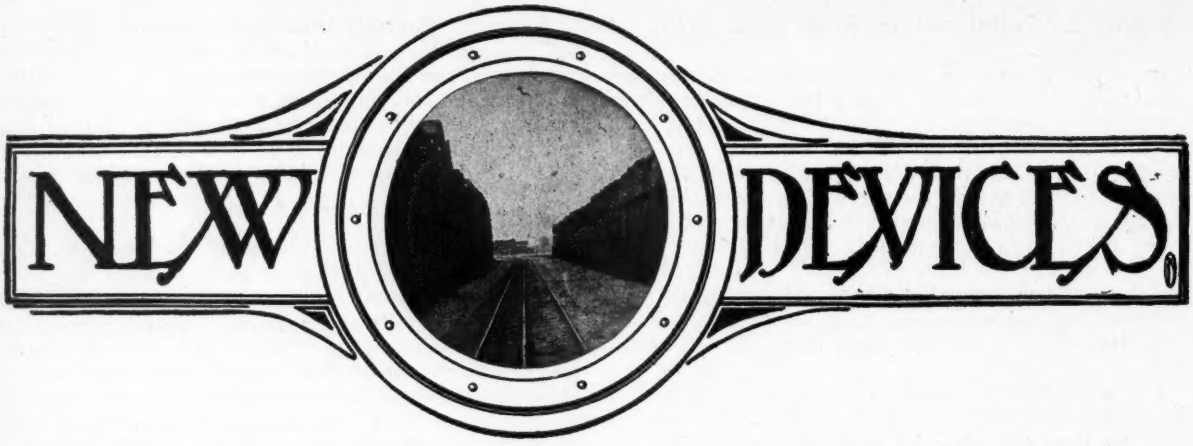
J. J. YATES,
Bridge Engineer, Central Railroad of New Jersey, Jersey City, N. J.

Correction

THE article published on page 309 of the August issue, entitled "How the Railways Maintain Their Bridges and Trestles," by G. W. Rear, engineer of bridges, Southern Pacific, Pacific System, was abstracted from a paper presented before the Pacific Railway Club of San Francisco, Cal., on May 17. This credit was unintentionally omitted when the article was published.



The President's Funeral Train at the Kedzie Avenue Station of the Chicago & North Western, Chicago

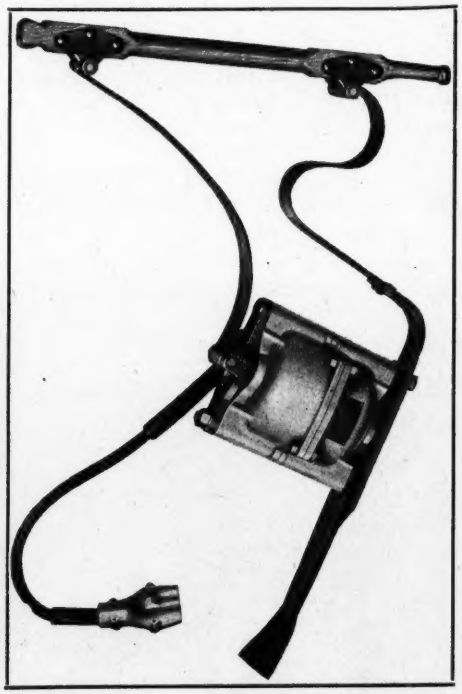


Three Years Service With the Electric Tie Tamper

WHEN the electric tie tamper was introduced about three years ago, it attracted wide attention because of the intense interest on the part of railway maintenance officers in any development designed to reduce the cost of one of the most arduous operations involved in track maintenance. However, at that time attention was turned primarily toward the basic principles and mechanical features of the equipment, as no service data were available on which to base conclusions regarding its adaptability in actual service. The intervening time has changed the situation materially. The special adaptability of this tamper to electric railway service had led to its use on such lines to a sufficient extent to demonstrate the practicability of the tamping unit as operated from current taken from trolley wires. On the other hand, the use of 100 tampers on several large steam roads indicates the development which has taken place in the use of this equipment as operated by portable gas engine generator sets where the electric current required is not available from other sources.

The tamping units have been subjected only to minor modifications from the design as described in the *Railway Maintenance Engineer* for March, 1920, page 92. These tampers consist essentially of the tamping tool rigidly connected to a metal case containing a one-horsepower electric induction motor and given a rapid pulsating motion through the agency of an eccentric weight attached to one end of the motor shaft. Heavy nickel steel shafting with ball bearings are provided to insure against any trouble with the bearings as a consequence of the heavy duty imposed upon them by the vibration set up, while the use of the induction or squirrel-cage motor, which requires no armature, collecting rings or brushes, does away with any trouble with the brushes or armatures from the same cause. According to information furnished by the manufacturers, the correctness of these features of design have been fully demonstrated by the low maintenance cost experienced in the three years' service to which this equipment has been sub-

The Portable Generator Supplying Current to Four Tampers



The Tamper

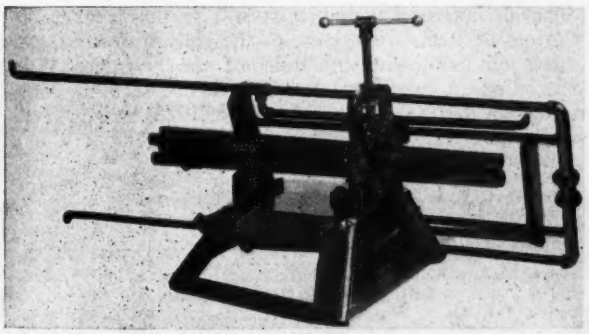
jected. About the only change of any importance which has been made in the tamper has been to provide a two-spring connection to the operator's handle instead of one. This insures better control of the tool in service and provides adequate cushioning between the motor and the hands of the operator.

The power plant supplied with this equipment where electricity is not available along the track, is the 1.25-kw. induction motor generating 3-phase, 60-cycle alternating current at 110 volts, belt connected to a 5-h.p. 4-cycle air-cooled engine. The total weight of the equipment with its supporting frame is 490 lbs. The construction is compact, takes up little room, and is readily moved to the work on a push car being supplied with handles by means of which it is readily lifted from the car to the ground alongside the track, or vice versa. The plant will supply current for four tampers, but may also be used for the operation of other electric tools.

Experience with the equipment has demonstrated the effective results that can be obtained with these tampers. It is said to be manipulated readily by track laborers without a great deal of experience. The equipment is normally furnished with 250 ft. of conductor cable between the power plant and the tamper, this length of cable being readily handled over the track and making it possible to conduct work on the track over a distance of 500 ft. from a given position of the power plant. The operation of the engine generator set is said to be practically automatic, no other attention being necessary than that incident to stopping and starting and occasional oiling, so that no other attendance is necessary than that which the foreman can give it without interferance with his other duties. The electric tamper is manufactured and sold by the Electric Tamper and Equipment Company of Chicago.

A Portable Vise Stand and Pipe Bending Tool

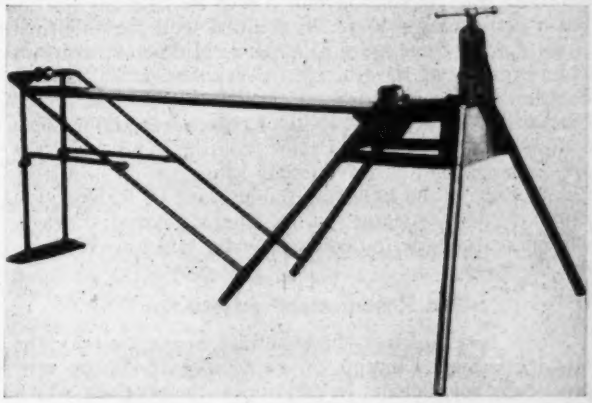
A PORTABLE vise stand and pipe bender has been developed by H. B. Martin & Sons, Owensboro, Ky., which is built of No. 16 sheet iron, riveted in place and braced at the corners with angle irons, which serve also as sockets for the four supporting legs. These legs are



The Large Size Stand Assembled for Transporting

lengths of steel tubing, made long and strong enough to support the frame at a convenient height for use and at the same time extend outward sufficiently to brace the stand against upsetting, tilting or skidding without requiring other support, whether upon a floor, sidewalk or the ground. The stand is equipped either with a hinge or chain vise, as desired, which is fixed rigidly to the top of the frame at one end in such a position that short nipples can be threaded without injury to the hands. At the end of the frame a device is provided which serves both as a guide and a rest for pipe while it is being cut or threaded and as a means of bending pipe or conduits from ⅛ in. to ¾ in. in diameter. The latter device is always ready for instant use without adjustment and is said to enable bends to be made not only free from kinks but at the exact point in the pipe where they are wanted.

When it is desired to dismantle the equipment the legs are simply pulled out of the sockets and fastened in the vise, whereupon a handle is provided in a convenient position with which to carry the outfit. Since the sides of the frame are open, with a brace across the bottom of these sides, the frame also provides a convenient rest

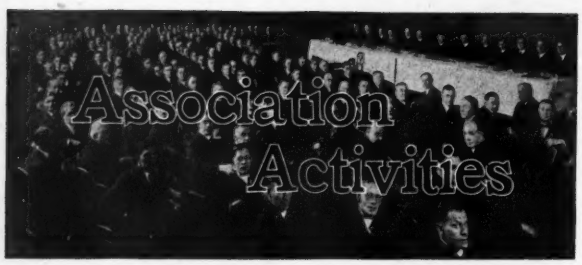


The 4½-In. Capacity Stand Set-Up with a Rear Support for Handling Full Lengths of Pipe

for the pipe tools where oil from the stocks will drain off without running down the handles. The equipment as described weighs 50 lb., is said to take but one-half minute to assemble or dismantle and can be set up in a 6-ft. by 8-ft. space.

The outfit described is built to handle pipe ranging from ⅛ in. to 2½ in. in diameter. For pipe up to 4½ in. in diameter a heavier stand is provided with which is also furnished a rear support, permitting full length of pipe to be used without tilting the stand. A roller on this rear support, aside from keeping the correct alinement, enables one man to move full lengths of pipe forward or backward at will. With this equipment the bender capacity is one inch. The weight complete with a four-inch hinge vise is 172 lb. and with a chain vise, 156 lb.

Track Work in the Philippines



Bridge and Building Association

The following additions have been made to the program for the convention which will be held in Seattle, Wash., on October 16-18, in addition to those published in the August issue, page 330. R. J. Middleton, assistant chief engineer of the Chicago, Milwaukee & St. Paul, at Seattle, Wash., will speak at the opening session of the convention. Judge G. T. Reid, vice-president and western counsel of the Northern Pacific, Seattle, Wash., will address the convention on Tuesday afternoon on "Railway Companies and the Investing Public," and C. R. Knowles, superintendent of water service, Illinois Central, Chicago, will present a paper on concrete water tanks on Wednesday afternoon.

The Roadmasters' Association

Plans for the forty-first annual convention at the Hotel Sherman, Chicago, on September 18-20, are now practically completed. In addition to the program which was announced in the August issue, page 331, B. O. Johnson, assistant to the operating vice-president of the Northern Pacific, will describe railway conditions in Siberia at a session on Tuesday evening, Mr. Johnson having returned to this country recently after five years service with the Russian Railway Service Corps in the far east.

The Metropolitan Track Supervisors' Club has arranged for a special train leaving New York on Sunday afternoon, September 17, and arriving in Chicago at four o'clock on the following afternoon for the convenience of those members of the Roadmasters' Association coming from the east for the convention.

Practically all of the space available for the exhibit of the Track Supply Association has now been assigned, a total of 62 firms having now taken membership and 57 having arranged for exhibits. Firms which have taken space since the last issue include:

Air Reduction Sales Company, New York City.
Electric Tamper & Equipment Company, Chicago.
J. P. Fleming & Sons Company, Inc., Scranton, Pa.
O. & C. Company, New York City.
Railway Purchases and Stores, Chicago.
Safety Guard Rail Lock Company.
Stevens Metal Products Company, Niles, Ohio.

CANADIAN ROADS HAVE GROWN—Forty-five years ago there were no railways and very little or no export in the three prairie provinces of western Canada, while at present these provinces are exporting between 200,000,000 and 300,000,000 bushels of wheat annually, aside from the large export of other grains and farm products, according to J. G. Sullivan, former chief engineer of the Canadian Pacific, in a paper presented before the American Society of Civil Engineers, at Chicago, on July 11. Beginning in 1881, when the population of Manitoba, Saskatchewan and Alberta was 102,000, the construction of railroads has increased at the rate of about 1,000 miles per year, until in 1921 it amounted to 15,270 miles of line, at which time the population was 1,956,000.

The Material Market

A CONTINUATION of purchases on a liberal scale and a tendency towards decreased production have served to stabilize prices in the iron and steel industry. The recently announced program for the elimination of the 12-hour day in the mills, although as yet by no means generally effective, has had considerable influence in curtailing production. Another new factor in the market is the inception of rail purchases for 1924, one railroad—the Norfolk & Western—having contracted for 50,000 tons with an arrangement for the determination of the price at a later date. However, within the last few days, several mills have announced the continuation of the $43 price for the first half of 1924. In the case of structural steel there is also a tendency toward more interest on the part of purchasers which, it is believed, will serve to counteract the low ebb of business recorded in July when the tonnage booked fell to 113,331 tons, the lowest figure for in a period of 16 months, with the exception of November, 1922. The general effect of the conditions outlined above has been to hold prices substantially at the level maintained for the past month and, as will be noted in the table below, no changes of price have taken place.

Prices in Cents Per Pound

	July 20		August 20	
	Pittsburg	Chicago	Pittsburgh	Chicago
Track spikes	3.15	3.25	3.15	3.25
Track bolts	4.00 to 4.25	4.25	4.00 to 4.25	4.25
Angle bars	2.75	2.75	2.75	2.75
Tie plates, steel	2.55 to 2.60	2.60	2.55 to 2.60	2.60
Tie plates, iron		2.85		2.85
Plain wire	2.75	3.09	2.75	3.09
Wire nails	3.00	3.34	3.00	3.34
Barbed wire, galv.	3.80	4.14	3.80	4.14
C. I. pipe, 6 in. to 12 in., per ton		$60.20		$60.20
Plates	2.50	2.60 to 2.80	2.50	2.60 to 2.80
Shapes	2.50	2.60 to 2.70	2.50	2.60 to 2.70
Bars, soft steel	2.40	2.50 to 2.60	2.40	2.50 to 2.60

Open hearth rails per gross ton f.o.b. mill, $43.

The scrap market is in better condition than it has been for a number of months. Although the market is still weak, there is less tendency toward marked reductions in price than for some time in the past.

	Prices Per Gross Ton at Chicago	
	July	August
Relaying rails	$32.00 to $35.00	$32.00 to $35.00
Rails for rerolling	18.00 to 18.50	17.50 to 18.00
Rails less than 3 ft. long	19.50 to 20.00	19.00 to 19.50
Frogs and switches cut apart	17.25 to 17.50	16.00 to 16.50
Steel angle bars	16.00 to 16.50*	17.25 to 17.75

*Prices per net ton.

The lumber market manifests still further reductions in prices of items of interest to the railway purchasers. Orders on hand with the mills of the Southern Pine Association on July 27 totalled 233,000,000 ft. b. m. compared with 450,000,000 on March 16, 1923, and as compared with 302,000,000 on July 21, 1922.

SOUTHERN PINE MILL PRICES

	July	August
Flooring, 1x4, B. and B. flat	$48.45	$46.95
Boards, 1x8, No. 1	39.35	39.00
Dimension, 2x4, 16, No. 1 common	30.05	26.20
Dimension, 2x10, 16, No. 1	28.95	28.70
Timbers, 4x4 to 8x8, No. 1	31.90	29.30
Timbers, 3x12 to 12x12, rough	43.75	36.80

DOUGLAS FIR MILL PRICES

Flooring, 1x4, No. 2, clear flat	40.00	34.00
Boards, 1x6, 6x20, No. 1, common	17.50	16.50
Dimension, 2x4, 16, No. 1, common	19.50	18.50
Dimension, 2x10, 16, No. 1, common	19.50	19.50
Timbers, 6x6 to 8x8, No. 1, common	24.00	24.00
Timbers, 10x10 to 12x12, rough	26.00	26.00

The production of portland cement continues on a maximum basis entirely in line with the record production for the first half of the present calendar year. Prices are practically stationary. Following are barrel prices in carload lots not including package:

Chicago	$2.20	Albany	$2.47
Cincinnati	2.54	Buffalo	2.53
Davenport, Ia.	2.43	New York	2.40
Minneapolis	2.50	Philadelphia	2.56
Pittsburgh	2.24	Richmond, Va.	2.62
Boston	2.78	Charleston, S. C.	2.71

General News

The Department of Railways of Japan has recently imported 35,000 American cedar cross ties. This is the first attempt ever made to use American cedar for ties in Japan.

A reward of $100 has been offered by the management of the Chicago, Rock Island & Pacific to the officer or employee of the road who by his efforts makes the largest saving by eliminating waste in labor or material during the month of August.

The Union Pacific now has under construction 53.8 miles of second track, 43 miles of which lies between Granger, Wyo., and Leroy, and 10.8 miles between Emory, Utah, and Echo, upon the completion of which the only portion of the Union Pacific between Council Bluffs and Ogden not double-tracked will be 27.1 miles between Echo, Utah, and Gateway.

The organization which constructed the government railroad in Alaska and has charge of its operation, is hereafter to be known as the Alaska Railroad instead of the Alaskan Engineering Commission, by order of the Interior Department, effective August 20. This change of designation was decided upon on account of the fact that the railroad has now been completed and is entirely under operation.

The Minneapolis & St. Louis, with general offices at Minneapolis, was placed in the hands of a receiver on July 27 following the filing of a petition in the Federal District Court by the Minneapolis Steel & Machinery Company, setting forth indebtedness of about $15,000 for repairs to locomotives and cars which the railroad company admitted its inability to pay. It consented to the appointment of a receiver.

A department of Personnel and Public Relations has been established on the Chicago, Rock Island & Pacific, which will have supervision of wages and working conditions, recreation among the employees, the development of educational activities, and the promotion of improved working conditions. The department is headed by Hal F. Ray, heretofore assistant to the president.

The Colorado Midland has given to the state of Colorado three trestles which the state will use as highway crossings in conjunction with a tunnel previously given to the state. It is expected that the former roadbed of the Midland from Divide to Glenwood Springs, a distance of about 260 miles, on which operations were suspended in 1919, will be used as a scenic highway.

The Norfolk & Western has recently completed the installation of flood lighting systems in 15 yards, comprising all of its main line yards. The lighting system consists essentially of flood lighting units mounted on platforms on steel towers 70 ft. high. There are four to eight projectors on each tower, depending on the area to be lighted. This replaces the common system of lighting yards by arc lamps or by individual electric lights.

A complete report of the elections which have been held during the year on the Pennsylvania, to fill the expiring terms of employee representatives in various departments of the road under the plan of employee representation in effect on that road, showed that out of 141,439 eligible employees in the shop crafts, clerical, miscellaneous and maintenance of way forces concerned with elections held this year, a total of 110,918, or 78.1 per cent, participated in the balloting. The returns for the maintenance of way department elections for the entire system show that out of 51,446 employees eligible in this group, 36,682, or 74.9 per cent, voted. It is regarded as significant that out of all the ballots cast, only 5 per cent were discarded by tellers as improperly voted. The tellers are appointed by the employees and the management.

The Mexican government will finance and extend the Kansas City, Mexico & Orient in the state of Chihuahua northwest of Salomii, in that state, across the Concho river to within 30 miles of Presidio, Tex., thereby making retribution in part for the damage done the Orient property in Mexico during the revolution, according to announcement by the receiver of the Kansas-Oklahoma division of the Orient and the president of the Texas system. The extension will shorten to less than 100 miles the 160-mile gap between Alpine and the line in Chihuahua, which gap is the principal obstacle in the way of completing the transcontinental line in that country.

Those who have been familiar with the views of President Coolidge and with his career in Massachusetts are confident that his attitude towards the various transportation problems will be a constructive one. As governor of Massachusetts he was in close touch with the transportation problem of New England and is understood to have given considerable thought and to have gained much accurate information as to transportation questions in general. Also, while vice-president, Mr. Coolidge participated in cabinet meetings, a fact which is credited with considerable weight in view of his declared intention to carrying forward the policies outlined by President Harding.

At hearings on the railway consolidation plan before the Interstate Commerce Commission, President A. H. Smith of the New York Central expressed the desire of this company to acquire the Philadelphia & Reading and the Central of New Jersey, to provide an additional trunk line into New York and thus relieve the company's present line across New York state, which is rapidly reaching its capacity. The proposed new trunk line extends from Ashtabula, Ohio, over an existing New York Central line which is operated with trackage rights over the Pennsylvania and the Buffalo, Rochester & Pittsburgh for short distances to Newberry Junction, Pa., where connection is made with the Reading, which in turn connects with the Central of New Jersey. The distance from New York to Ashtabula by this route is 520 miles, or 40 miles shorter than the New York Central's present main line.

A new high record for the weekly loading of revenue freight was established for the fourth time this year when, on July 28, a total of 1,041,044 cars were loaded; and the million mark in weekly loading was exceeded for the ninth time this year, when on the following week, 1,033,130 cars were loaded. The loading for the week ending July 28, when the new high record was established, was 192,186 over the total for the corresponding week of 1920 and 245,612 greater than for 1921. The loading for the two successive weeks were 8,000 cars and 68,000 cars less, respectively, than this loading, the loading for the week ending August 11 being only 973,162 cars. The reduction in loading for the latter week is attributed entirely to the closing down of industries for various periods during the week of the funeral of the late President Harding. Coincident with the increase in car-loading the freight car surplus has continued to decrease and the car shortage to increase slightly. As of that date the average surplus was 74,168 cars, a decrease of 2,285 as compared with the period ending July 31, while the reported shortage averaged 10,149 cars or an increase of 579 in approximately a week.

Personal Mention

General

J. A. Gillies, trainmaster on the Atchison, Topeka & Santa Fe, with headquarters at Dodge City, Kan., and formerly district engineer, has been promoted to assistant superintendent, with the same headquarters.

R. H. Keays, assistant general superintendent for the Uhlen Contracting Corporation, contractor for the Shandaken tunnel for the Catskill water supply of New York City, has been appointed chief engineer of the Moffat Tunnel Commission, created by the state of Colorado to build a 6-mile tunnel through the Continental divide on the line of the Denver & Salt Lake, about 50 miles west of Denver. **C. A. Kauffman,** who had charge of the surveys for the Moffat tunnel, has been appointed assistant chief engineer of the commission, and **L. D. Blauvelt,** state highway engineer of Colorado, and formerly chief engineer of the Denver & Salt Lake, has been appointed a member of the consulting force.

Engineering

R. W. E. Bowler, division engineer on the Pennsylvania, with headquarters at Grand Rapids, Mich., has been transferred to the Toledo division, with headquarters at Toledo, Ohio, succeeding **W. R. Hillary,** transferred.

A. C. Shields, division engineer on the Chicago, Rock Island at Trenton, Mo., has been appointed engineer maintenance of way, a newly created position, on the Denver & Rio Grande Western with headquarters at Denver, Colo.

G. E. Moberly, assistant division engineer of the Utah division of the Oregon Short Line, with headquarters at Pocatello, Idaho, has been promoted to division engineer of that division, with the same headquarters, succeeding **R. B. Reasoner,** deceased.

F. S. Squire, valuation engineer of the Oregon-Washington Railroad & Navigation Company, with headquarters at Portland, Ore., has been appointed engineer western group of the Presidents' Conference Committee of Valuation, with headquarters at Chicago, succeeding **J. R. Leighty,** whose appointment as special engineer in charge of valuation of the Southern, with headquarters at Washington, D. C., was reported in the May issue.

O. T. Rees, assistant chief chemist of the Atchison, Topeka & Santa Fe, with headquarters at Topeka, Kans., has been promoted to chief chemist with the same headquarters to succeed **W. A. Powers** who has retired. Mr. Powers was born at Knoxville, N. Y., on March 14, 1866, and was educated in chemistry at the University of Illinois. He entered railway service on March 15, 1897, as chief chemist of the Atchison, Topeka & Santa Fe, a position which he has held continuously for 26 years.

H. R. Clarke, engineer maintenance of way of the Nebraska district of the Chicago, Burlington & Quincy, with headquarters at Lincoln, Neb., has had his jurisdiction extended over the Wyoming district, relieving **R. G. Aylsworth,** who has been granted leave of absence. **H. C. Murphy,** division engineer and roadmaster of the Quincy, Omaha & Kansas City, with headquarters at Kansas City, Mo., has been promoted to assistant engineer maintenance of way of the Wyoming district of the Burlington, with headquarters at Alliance, Neb.

J. D. Hodgdon has been appointed assistant engineer on the Kansas, Oklahoma & Gulf, with headquarters at Baxter Springs, Kans., with charge of the building of a northern extension of this line from Baxter Springs to Military Junction. During the four years previous to his connection with the Kansas, Oklahoma & Gulf, Mr. Hodgdon was engaged in a consulting capacity for the city of Baxter Springs in connection with the construction of sewers, waterworks and pavings. He was city engineer of Joplin, Mo., from 1907 to 1911 and commissioner of streets and public improvements under commission form of government from 1914 to 1918.

Frederick Mears, chairman and chief engineer of the Alaskan Engineering Commission prior to the completion of the Alaskan government railway, has been appointed chief engineer of the Union Depot Company, St. Paul, Minn., to succeed **W. C. Armstrong,** deceased. Colonel Mears was born on May 25, 1878, at Omaha, Nebr., and was educated at the Shattuck Military Academy, and in 1905 attended the U. S. Staff College at Fort Leavenworth, Kan. He entered railway service in June, 1897, and was engaged consecutively on the survey and construction of the Park Rapids extension of the Great Northern, the location and survey of the Coon creek cutoff, and as assistant engineer on the Kootnoi Valley (now a part of the Great Northern) until 1899. He entered the U. S. army in 1905 and in May, 1906, was appointed assistant engineer of the Isthmian Canal Commission at Panama, a position he held until May, 1907, when he was appointed resident engineer of the Panama railroad. In December, 1909, he became chief engineer and in 1913 was also made general superintendent. Having been appointed a member of the Alaskan Engineering Commission in May, 1914, he ultimately relinquished his connection with the Panama railroad to devote all of his time to the commission work. Re-entering military service in 1918, he served both in the United States and in France as an assistant general manager of the railroad department until May, 1919. In August, 1919, he was appointed chairman and chief engineer of the Alaskan Engineering Commission.

Frederick Mears

Track

Tom McGregor has been appointed roadmaster on the First district of the Breckenridge division of the Great Northern, with headquarters at Breckenridge, Minn., to succeed **J. Sullivan,** who has been transferred to the Third district of the Breckenridge division.

R. E. Meyer, whose promotion to roadmaster on the Chicago & North Western, with headquarters at Wall Lake, Ia., was reported in the August issue, was born on November 6, 1894, at Jonesburg, Mo., and entered railway service on July 2, 1913, as a section laborer on the Chicago, Burlington & Quincy at Bellflower, Mo. He left railway service on October 6, 1915, but returned on March 16, 1916, as a section laborer on the Chicago & North Western at Sac City, Ia. He was promoted to section foreman on July 16 of the same year and on April 1, 1918, was promoted to extra gang foreman, the position he held until January 27, 1922, when he was promoted to yard foreman of the Sioux City, Ia., joint yards, where he was located at the time of his recent promotion to roadmaster.

L. J. McMartin, whose promotion to supervisor of bridges and buildings on the Chicago & North Western, with headquarters at Escanaba, Mich., was reported in the August issue, was born on June 2, 1859, at Brockville, Ont. After serving three years in the east as a carpenter apprentice, he engaged in farming at DeKalb, Ill., in 1877. He entered railway service as an employee in the car department of the Chicago & North Western in 1879. He was transferred to the bridge and building department in 1882 and for three years was employed as a bridge carpenter. In 1885 he was promoted to gang foreman and held this position until 1900, when he became assistant general foreman. He was promoted assistant supervisor of bridges and buildings in 1909, which position he held at the time of his recent promotion.

Isaac E. Short, whose promotion to roadmaster on the Missouri Pacific, with headquarters at Downs, Kan., was reported in the August issue, was born on January 10, 1888, at Crane, Mo., and completed a course of study at the Springfield Normal and Business College, Springfield, Mo. He entered railway service in February, 1907, as an extra gang laborer on the Missouri Pacific and in 1915 was promoted to extra gang foreman. He held this position until June 7, 1917, when he enlisted in the Twelfth Engineers' Light Regiment, with which he served 21 months overseas. After being discharged on May 16, 1919, as a sergeant, he re-entered the service of the Missouri Pacific as extra gang foreman and continued in this capacity until August 5, 1921, when he was appointed acting roadmaster, which position he held at the time of his recent promotion to roadmaster on the Northern Kansas division.

Bridge and Building

O. E. Baer has been appointed general foreman of bridges, buildings and water service on the Arkansas River division of the Atchison, Topeka & Santa Fe, with headquarters at La Junta, Colo., succeeding **Julius Froese,** who has retired on a pension.

Paul Paulson, whose promotion to supervisor of bridges and buildings on the Dakota division of the Chicago & North Western was reported in the August issue, was born on June 27, 1873, in Sweden, and in 1893, after completing high school, became a hoistng engineer for Widell & Company at Mankato, Minn., where he was employed until 1903. He entered railway service in April, 1903, as a pile-driver engineer on the Chicago & North Western, since which he has served consecutively as a bridge foreman, traveling mechanic, road foreman and assistant supervisor of bridges and buildings, serving in the latter capacity at the time of his recent promotion.

Francis Ingalls, supervisor of bridges and buildings on the Dakota division of the Northern Pacific, with headquarters at Jamestown, N. D., retired on August 1, after having been engaged in railway service half a century and as supervisor at Jamestown for 41 years. Mr. Ingalls was born on June 8, 1853, at Danvers, Mass., where he attended high school. He entered railway service in 1866, and was employed for 16 months as a station helper on the Eastern railroad (now a part of the Boston & Maine) at Danvers, Mass., prior to the completion of his schooling. Mr. Ingalls entered railway service as a permanent occupation in 1870 as an apprentice in the bridge and building department of the Boston & Maine. Completing his apprenticeship in 1873, he was employed as a carpenter for the same line until 1874, and from 1874 to 1878 as a foreman in the bridge and building department. He left railway service in 1879 and migrated to Leadville, Colo., where he remained until 1881, when he re-entered railway service as a car clerk on the Northern Pacific. In February, 1882, he became a carpenter in the bridge and building department at Fargo, and three months later was made foreman. Promoted to supervisor of bridges and buildings on November 1, 1882, he has continued in that capacity at Jamestown until his recent retirement, during which the territory over which he originally had jurisdiction has increased from 200 miles to 788. As a tribute to Mr. Ingalls for his long and faithful period of service, a meeting was held at St. Paul, which was attended by the vice-president, assistant vice-president, supervisors and all the staff of the engineering department.

Obituary

Henry B. Cartwright, district engineer on the Seaboard Air line, with headquarters at Jacksonville, Fla., died on July 14, after a lingering illness. Mr. Cartwright was born in Weeksville, N. C., on December 17, 1883, and was educated in civil engineering at the North Carolina State College, graduating in 1905. Entering railway service as an inspector on the Seaboard Air line shortly following the completion of his studies, he served successively as an inspector and assistant engineer and subsequently became district engineer in charge of the Jacksonville, Fla., office, with jurisdiction over all engineering work in that district.

Construction News

The Alexandria & Western has awarded a contract to List & Gifford, St. Louis, Mo., for the construction of a five-mile extension from Alexandria, La., to McFarland, the cost of which will be approximately $50,000.

The American Niagara has applied for authority to construct a 10-mile line in Erie county, N. Y., from a connection with the New York Central at its junction with the Lehigh Valley at Tonawanda Junction to a point on the railroad of the Canadian Niagara Bridge Company at the international boundary in the Niagara river.

The Atchison, Topeka & Santa Fe has been authorized to construct an extension at Wilmington, Cal., at an estimated cost of $20,000 and has requested authority to construct a 7-mile branch line from a point between Kaw and Soldeni, Okla., to the east line of Kay county, Okla.

This company contemplates the construction of a new freight terminal in the northern part of San Diego, Cal., is calling for bids for the construction of a new tin and pipe shop at Bernardino, Cal., which will comprise the first step in the enlargement of terminal facilities ultimately to cost $2,000,000 there; and has awarded a contract to the Senne Construction Co., Topeka, Kans., for the razing of the office building at that point preparatory to its replacement by a 10-story structure, as reported in the April issue. This company has also awarded a contract to the Truscon Steel Company, for pressed steel buildings for use at a timber preserving plant now under construction at National City, Cal.

This company will construct two large water supply stations to serve a cut-off now under construction between Eldorado, Kans., and Elinor.

The Baltimore & Ohio, jointly with the Chicago, Burlington & Quincy, has purchased 200 acres of land near Washington Park, East St. Louis, Ill., and is now calling for bids for the construction of new yard tracks there.

The Beaver, Meade & Englewood has applied to the Interstate Commerce Commission for authority to construct an extension from Forgan to Hooker, Okla., 39.2 miles, with a view to an eventual further extension to Des Moines, N. M.

The Chesapeake & Ohio has awarded a contract to Jos. E. Nelson & Sons for the construction of water treating plants at Foster, Ky., Edgington, Stony Point, South Portsmouth and Maysville.

The Chicago & Eastern Illinois is contemplating the construction of a new freight yard at Terre Haute, Ind., in connection with a new locomotive and car shop as was reported in the July issue.

The Chicago & North Western has awarded a contract to the T. S. Leake Construction Company, Chicago, for the construction of a 22-ft. by 80-ft. passenger station and for the construction of a 72-ft. by 50-ft. freight station at Eagle River, Wis.

The Chicago, Burlington & Quincy, jointly with the Chicago & Alton, contemplates the construction of a union passenger station at Jacksonville, Ill. This company closed bids on August 8 for the construction of a passenger station at Lamunt, Iowa.

This company has awarded a contract to the Graver Corporation, East Chicago, Ind., for the erection of a 15,000-gal.-per-hour water softener at Scotts Bluff, Neb.

The Chicago, Milwaukee & St. Paul has awarded a contract to Jos. E. Nelson & Sons for water treating plants at Bensonville, Ill., and Mannheim.

This company awarded a contract during August to the Peterson, Shirley & Gunther Company, Omaha, Neb., and Roberts Bros., Chicago, for the grading for 23 miles of second track on its Terre Haute, Ind., line between Tallmadge, Ill., and Webster, and for 13½ miles of second track from West Dana, Ind., to Bradshaw. The ballasting, track-

laying and surfacing for the project will be done with company forces.

The Chicago, Rock Island & Pacific has authorized the construction of a new passenger station at Iowa Falls, Iowa, and additions to the passenger station, platform and canopy at El Dorado, Ark. A 400-ton coaling station and cinder pit will be built at Rock Island, Ill., a 200-ton coaling station and cinder pit at Council Bluffs, Iowa, a 400-ton coaling station at Eldon, Iowa, and a 300-ton coaling station at Dalhart, Tex. The company has also authorized the extension of four roundhouse stalls, the replacing of a cinder pit and the building of a drop pit at Haileyville, Okla., and the construction of four new stalls and the extension of 13 stalls in the roundhouse at Shawnee, Okla.

New water treating plants have been authorized at Cedar Rapids, Iowa; Albert Lea, Faribault and Owatonna, Minn.; Fairbury, Neb.; Scandia, Kan., and Willard.

The City of Bayonne, N. J., is developing plans for the development of a large rail-water terminal at this point and a public hearing will be held by municipal officers on August 28.

The Cleveland, Cincinnati, Chicago & St. Louis contemplates the construction of a new bridge across the Ohio river at Louisville, Ky., adjacent to the present structure.

The Detroit Terminal has awarded a contract to the Roberts & Schaefer Company, Chicago, for the installation of an electric cinder handling plant at Detroit, Mich.

The Cleveland Union Station has awarded a contract to the Walsh Construction Company, Davenport, Iowa, for excavation of the new site of the Union Station at Cleveland, Ohio, this excavation to cost approximately $250,000.

The Florida East Coast will receive bids on September 5 for the construction of a new station at Daytona, Fla., to cost approximately $45,000.

The Fruit Growers' Express will build an icing station on the lines of the Pennsylvania at Huntington, Pa.

The Houston Navigation & Canal Commission has contracted for 1,080 lots of the Houston Harbor Addition for the construction of a railroad classification yard to accommodate about 4,000 freight cars in storage.

The Kansas City Southern will rebuild its car repair shop at Shreveport, La., damaged by fire on July 11, at a loss of $125,000, including equipment.

This road is preparing plans for reductions in grade on its line between Watts, Okla., and Neosho, Mo., a distance of 62 miles, to cost approximately $3,000,000.

The Illinois Central has been authorized by the Interstate Commerce Commission, in a decision made public on August 14, to construct a new cutoff line, 73 miles long, from Edgewood, Ill., to Paducah, Ky., with a branch from Aiken, Ill., to connect with the Benton Southern, to be operated by the Illinois Central. The application was granted over the protests of several communities in Illinois now served by the Illinois Central's Cairo line between Edgewood and Fulton, Ky.

This company plans the construction of a two-story passenger station, 380 ft. long, at Baton Rouge, La., where a two-story freight station and office building will also be constructed; has closed bids for the construction of a brick freight and passenger station at Bethany, Ill., to cost approximately $20,000; and has awarded a contract to the Howlett Construction Company, Moline, Ill., for the construction of a 500-ton reinforced concrete coaling station at Central City, Ky.

The Lake Erie & Western has authorized the construction of improvements and additions to its shops at Lima, Ohio, to cost approximately $150,000.

The Laurel Fork & Mendota has applied to the Interstate Commerce Commission for authority to construct a line from a point near North Holston, Va., to a connection with the Carolina, Clinchfield & Ohio at Kingsport, Tenn. John M. Kreger, Abingdon, Va., is president of the company.

The Lehigh & New England is contemplating the erection of a 14-stall roundhouse at Tamaqua, Pa

The Longview, Portland & Northern contemplates the construction of a line approximately 30 miles long from near Kelso, Wash., to Olequa, the cost of which is estimated at approximately $3,000,000.

The Louisville & Nashville has awarded a contract to the Frankfort Supply Company, Frankfort, Ky., for the excavation of the site for a new terminal at West Frankfort, Ky.

The Minarets & Western plans the construction of a new line 39 miles long from Friant, Cal., to the Crans Valley dam in Madera county. A branch line 7 miles long from Pinedale, Cal., to Pinedale Junction is also planned.

The Mississippian has applied to the Interstate Commerce Commission, for authority to construct a 25-mile line from Amory to Fulton, Miss. John T. Cochrane, Mobile, Ala., is president of the company.

The Missouri Pacific has begun the construction of a new general hospital at Little Rock, Ark., to cost approximately $450,000.

The Moffat Tunnel Commission will receive bids until September 12 for the boring of a main tunnel 16 ft. by 24 ft. and a pioneer tunnel 8 ft. by 8 ft. under James Peak, in Brand county, Colo. The tunnels will be approximately 6 miles long.

The Nashville, Chattanooga & St. Louis plans the construction of a new two-story passenger station and office building at Paducah, Ky., to cost approximately $250,000. This company has closed bids for the construction of an eight-story office building at Nashville, Tenn.

The National Railways of Mexico have awarded a contract to the Pioneer Transfer Company, Calexico, Cal., for the grading of the first 34 miles of new line from Mexicali to the Gulf of California, which was reported in the July issue. The cost of the first section will be approximately $338,000.

The New York Central has applied to the Interstate Commerce Commission for a certificate authorizing the construction of a line 2.1 miles from a connection with its main line near Depew, N. Y., to a connection with the West Shore near Bowmansville.

The New York, Chicago & St. Louis has awarded a contract to the Roberts & Schaefer Company, Chicago, for the construction of a 700-ton reinforced concrete coaling station with automatic elevating equipment at Conneaut, Ohio.

The Okmulgee Northern has made application to the Interstate Commerce Commission for authority to construct two extensions to its line, the first, designated as the Southwestern, to extend 15½ miles through Okmulgee and Okfuskee counties, Okla., and the second extension, known as the Oktaha cutoff, to extend 26 miles through Okmulgee and Muskogee counties, connecting with the Missouri-Kansas-Texas lines at Oktaha, Okla.

The Oregon Short Line has awarded a contract to the Utah Construction Company, Salt Lake City, Utah, for the construction of a secondary main line from Orchard, Idaho, to Boise, estimated to cost over $3,000,000 which will include the construction of new freight and passenger stations at Nampa and Boise. The same company has been awarded a contract for the reduction of grades between Revere, Idaho, and Chalk, a distance of 4 miles. The railroad has been authorized to construct a line in Twin Falls county, Idaho, and Elko county, Nev., and a 2½-mile extension between Nampa, Idaho, and the Boise branch of the company.

The Pennsylvania is preparing plans for the elevation of its tracks at Lafayette street, Fort Wayne, Ind., at a cost of approximately $2,500,000 and the necessary rearrangement of shops there to cost $1,500,000.

This company has awarded a contract to the Roberts & Schaefer Company, Chicago, for the construction of a 700-ton reinforced concrete coaling plant with duplicate elevating equipment and a 120-ton gravity sand plant at Conemaugh, Pa.; and has awarded a contract to the Scott Construction Company, Indianapolis, Ind., for the construction of a highway bridge over its tracks east of Terre Haute, Ind., to cost approximately $100,000.

The Pennsylvania has awarded a contract to the Scott Construction Company, Indianapolis, Ind., for the construction of a bridge over its tracks east of Terre Haute, Ind., to cost approximately $100,000.

The Pere Marquette has awarded a contract to the Arnold Company, Chicago, for the construction of a 16-stall brick roundhouse and the installation of a 100-ft. turntable at Erie, Mich.

The Philadelphia & Reading has awarded a contract to C. P. Bower for the construction of a concrete retaining wall along Front street, Bridgeport, Pa., 210 ft. long and from 13 ft. 6 in. to 15 ft. 6 in. high, above foundations.

The Rockdale, Sandow & Southern has applied to the Interstate Commerce Commission for authority to complete the construction and to operate a line from a connection with the International-Great Northern at Marjorie to Sandow, Texas, a distance of 6½ miles.

The St. Louis-San Francisco has awarded a contract to the Howlett Construction Company, Moline, Ill., for the construction of a 300-ton, three-track, reinforced concrete coaling station at the Lindenwood yard, St. Louis, Mo., as reported in the August issue.

The Southern Pacific has completed plans for the construction of a one-story machine shop 85-ft. by 498-ft., in Los Angeles, Cal., to cost approximately $390,000 with equipment.

This company is completing surveys for a new 118-miles line from Oakridge, Ore., to Kirk, known as the Natron cutoff, the construction of which will begin immediately upon the completion of the surveys.

This company has been authorized to construct a new combination freight and passenger station at Glendale, Calif., to cost approximately $50,000, and plans the construction of a new power house at San Luis Obispo, Calif., to cost approximately $50,000.

The Temiskaming & Northern Ontario has awarded a contract to the R. A. and I. A. Sinclair Company, Toronto, Ont., for the construction of a 25-mile branch line from Swastika, Ont., eastward to Kirkland, Ont.

The Terre Haute, Indianapolis & Eastern (electric) jointly with the Interstate Public Service Company, the Union Traction Company, and the Indianapolis & Cincinnati Traction Company, plans the early construction of a large freight terminal at Indianapolis, Ind.

The Texas, Panhandle & Gulf has applied to the Interstate Commerce Commission for authority to construct a line 30 miles in length from Tucumcari, N. M., to Seymour, Texas, and in conjunction therewith to purchase, if possible, or lease from the Gulf, Texas & Western, a line 100 miles in length from Seymour to Salesville, Texas, and also to proceed with the construction of its own line from Perrin to Fort Worth, Texas, a distance of 57 miles.

The Union Pacific will construct a new 34-ft. by 190-ft. passenger station at Laramie, Wyo., to cost approximately $175,000; closed bids on August 15, for the construction of a new freight station and general office building at Yakima, Wash., to cost approximately $80,000; and plans the construction of a new passenger station at Long Beach, Cal. This company plans the construction of a 3-mile cut-off near Long Beach, Cal., and has awarded a contract to Peterson, Shirley & Gunther, Omaha, Neb., for the construction of 43 miles of second track between Granger, Wyo., and Leroy. This company has also awarded a contract to the Morrison-Knudson Co., Boise, Idaho, for the construction of 10 miles of second track between Emory, Utah, and Echo. The track laying and bridge construction on these projects will be done by company forces. This company plans the construction of a new water treating plant at Marysville, Kans.

The Wabash is making preparations for the elevation of its tracks at Lafayette street, Fort Wayne, Ind.

The Western Fruit Express will construct a general car repair shop at St. Paul, Minn., to cost approximately $150,000.

Supply Trade News

General

The Truscon Steel Company is preparing plans for a new plant at Pittsburg, Cal.

The Walsh Tie Company, Minneapolis, Minn., has been renamed as the Northern Tie and Treating Company. There will be no change in personnel. This company operates a timber treating plant at Minneapolis.

The Kendell Motor Products Company, Ft. Wayne, Ind., has been organized to take over the patent rights and business of the Kendell Engineering Corporation, manufacturers of piston rings. The directors of the new corporation are G. A. Smiley, C. P. Burns and R. L. Kendell, the latter being sales and advertising director.

Crerar Adams & Company, Chicago, have leased the four-story and basement building at the northwest corner of Morgan and Thirty-sixth streets for 10 years, with option to purchase, commencing October 21, 1923. The new building will be used as a warehouse and a general office.

The Texas Creosoting Company of Orange, Tex., has been organized by R. S. Manley and associates. It is planned to begin immediately the construction of a creosoting plant, which will be located on tidewater to facilitate the handling of export business over the company's wharf.

The National Lumber & Creosoting Company, Texarkana, Ark., has purchased the Central Creosoting Company, Chicago, Ill., and will transfer the headquarters to St. Louis, Mo. **John T. Logan,** president of the National Lumber & Creosoting Company, has also been elected president of the Central Creosoting Company, succeeding **J. B. Card.** The Central Creosoting Company owns and operates a two cylinder timber treating plant at Finney, Ohio.

Robert W. Hunt & Company, a co-partnership, has been incorporated under the name of the **Robert W. Hunt Company** with officers as follows: **Jno. J. Cone,** president, **D. W. McNaugher,** vice-president and treasurer, **C. B. Nolte,** vice-president and general manager, **W. A. Gresens,** secretary and assistant treasurer. The board of directors includes the above officers, also **Luther V. Rice** and **J. C. Ogden.** The official personnel of the corporations 20 domestic and 8 foreign or international offices remains unchanged.

The Connecticut Blower Corporation, Hartford, Conn., has been incorporated under the laws of Delaware with a capital of $250,000 for the purpose of manufacturing and installing blower and exhaust fans and systems for dust collecting, exhausting and ventilating uses, etc. This company has taken over the International Blower Company and the Hartford Sheet Metal Works and will utilize the plant of the International Blower Company pending the occupancy of a considerably larger plant. The officers of the company are **M. E. Keeney,** president; C. H. Keeney, treasurer, and C. E. Keeney, secretary.

The Kettle River Treating Company has been incorporated in Illinois to acquire control and operate the Madison, Ill., treating plant of the Kettle River Company of Minneapolis. While the stock of the new corporation is practically all owned by the Western Tie & Timber Company, St. Louis, Mo., the Kettle River Treating Company will be operated as a separate corporation, treating ties for railways, other tie companies and other purchasers. No change has been made in the management or personnel of this plant.

The W. N. Matthews Company, manufacturers of mechanical painting equipment and railway electrical specialties, St. Louis, Mo., has been reorganized as the W. N. Matthews Corporation, with the same headquarters. **W. N. Matthews** continues as president of the new company and **C. L. Matthews** as vice-president and secretary. **C. C. Fredericks,** general manager of the W. N. Matthews Company, has been elected vice-president and general manager of the new corporation and **A. G. Williams** has been appointed manager of

railroad sales. Mr. Williams started as mechanical apprentice in the Altoona, Pa., shops of the Pennsylvania railroad and was promoted though various positions to that of engineer of motive power of the Southwestern region, with headquarters at St. Louis, Mo., which position he resigned on May 1 to take charge of the railroad sales of the mechanical painting equipment of the W. N. Matthews Corporation.

Personal

J. J. Murphy, formerly the Chicago representative of the Browning Engineering Company, Cleveland, will represent the Orton & Steinbrenner Company, Chicago.

W. G. Sharretts, representing the Western Wheeled Scraper Company, Aurora, Ill., is now in charge of the New York City office of that company at 50 Church street.

H. L. Erlicher, formerly assistant to the general purchasing agent of the **General Electric Company,** Schenectady, New York, has been appointed assistant general purchasing agent.

Thomas Gannon, vice-president of the Sharp & Fellows Construction Company, Los Angeles, died in that city on August 12. Early in his career Mr. Gannon was a roadmaster on the Chicago, Burlington & Quincy, since which he has been engaged continuously in contracting work, having been prominently associated with the construction of the Belen cut-off of the Santa Fe in 1908, and also the double tracking recently undertaken for the Santa Fe in the vicinity of Kingman, Ariz.

John N. Reynolds, formerly western manager of the Railway Age, whose death in San Diego, Calif., on July 10 was noted in the August issue, was born in England on August 24, 1846, and began his career in newspaper work with the Boston Advertiser in 1872. In the same year he became associated with Edward Vernon and others in preparing and publishing, in 1873 and 1874, the "American Railroad Manual of the United States and the Dominion." From 1874 to 1881 he was connected with Poor's Manual of Railroads. The entrance into the field of the Railway Age began in 1875, when he entered the business department of the Railroad Gazette. From 1881 to 1894 he was connected with the National Car and Locomotive Builder; and in 1881 published the first directory of street railways of the United States, Canada, Mexico and South America. From 1894 to 1901 Mr. Reynolds was western representative of the Railroad Gazette. He became vice-president of the Railway Age in May, 1901, which position he held until May, 1908. On June 1, 1908, the Railroad Gazette, which was published in New York, and the Railway Age, which was published in Chicago, were consolidated, and Mr. Reynolds was appointed western manager of the consolidated papers. He continued to hold this position until January, 1913, when he retired, later moving to San Diego, Calif., where he lived until the time of his death. Mr. Reynolds' active connection with railroad publications extended over a period of 40 years. Mr. Reynolds was a lovable man with a quiet, unobtrusive manner and an example in his devotion to his family. His one hobby was collecting postage stamps, and at one time there were few better private collections in the country.

John N. Reynolds

John Brunner, assistant inspecting engineer of the **Illinois Steel Company,** with headquarters at Chicago, has been promoted to manager of the newly created department of metallurgy and inspection, with the same headquarters. **R. G. Glass** has been appointed assistant manager in charge of the bureau of investigation, and **F. S. Crane** has been appointed assistant manager in charge of the bureau of inspection of the department of metallurgy and inspection, both with headquarters at Chicago.

F. P. Hamilton, vice-president, general manager and sales manager of the Creosoted Materials Company, Inc., with headquarters at New Orleans, La., has been elected president, succeeding **R. S. Manley,** who has resigned to become president of the Texas Creosoting Company of Orange, Tex. **D. E. Roach,** secretary and treasurer, has resigned to become secretary and treasurer of the Texas Creosoting Company. In the future the Creosoted Materials Company, Inc., will sell the creosoted materials manufactured by the Southern Creosoting Company, Ltd., of Slidell, La.; the Texas Creosoting Company of Orange, Tex., and others.

J. M. Marshall, assistant to the district engineer at New York, of the **Portland Cement Association,** Chicago, has been appointed district engineer of the office at Atlanta, Ga., succeeding **Walter B. Elcock,** who has been appointed assistant general manager in charge of the southeastern offices, with headquarters in the Hurt building, Atlanta. **J. R. Fairman,** field representative in Kansas and Missouri, has been appointed district engineer in charge of a new office recently opened in Birmingham, Ala.; **James A. Hudson,** field representative in Mississippi, has been appointed district engineer in charge of a new office in Memphis, Tenn., and P. H. Johnston, field engineer in Florida, has been appointed district engineer in charge of a new office in Jacksonville.

Trade Publications

Zinc Roofing.—In an eight-page leaflet, the New Jersey Zinc Company illustrates and describes the standing-seam Horse Head zinc roofing manufactured by that company, and outlines the method of installation.

Stop That Rot—The C-A-Wood Preserver Company, St. Louis, Mo., has recently issued a 44-page illustrated large size booklet, describing the use and results obtained by C-A-Wood Preserver, manufactured by that company. The text of the booklet gives in considerable detail the various methods of such a brush, spray, dipping, soaking, for the treatment of timber against decay in conjunction with a large amount of other treating and preservative data, such as service records, volatility curves, etc.

Rolling Steel Doors.—The J. G. Wilson Corporation, New York City, has recently issued catalogue No. 35, a 72-page illustrated, large-size booklet, descriptive of the various styles of rolling steel doors manufactured by this company. The first part of the booklet describes and illustrates the various types of doors, showing how the gear drives are arranged, type and arrangement of the slats and methods for mechanical drive installations. The latter part of the book contains a large number of illustrations of rolling steel door installations on a wide variety of buildings under all classes of circumstances.

Cranes.—The Industrial Works, Bay City, Mich., has issued an elaborate 160-page catalogue commemorating the completion of 50 years in the construction of cranes of various types. The book opens with a detailed history of cranes, presenting the development of equipment for the handling of heavy materials from the time of the pyramids up to the present time. The remainder of the book is divided into sections, the first of which describes locomotive cranes of rail, traction and crawling tractor designs. The second section is devoted to locomotive crane accessories, including buckets, grapples, magnets and drag lines, while the third section presents wrecking cranes. Section four includes special railroad equipment, such as electric and hand-operated pillar and transfer cranes, portable rail saws and transfer tables. Section five describes combination pile drivers and locomotive cranes, steam pile hammers and pile driving leads, while section six is devoted to a description of the service which the Industrial Works is prepared to render foreign trade. The book is very attractively prepared and contains a lage amount of information regarding each of the designs of equipment. It is profusely illustrated with photographs showing details of the equipment and its use.

MAPAZ gives paint greater covering power

PURE—The New Jersey Zinc Company's French Process Green Seal Zinc Oxide ground in highly refined linseed oil.

BEAUTIFUL—Makes a white paint that is white and that stays white. Permits of purer tints where color is wanted.

RELIABLE—Ground only in accordance with specifications of The New Jersey Zinc Company by licensed paint manufacturers.

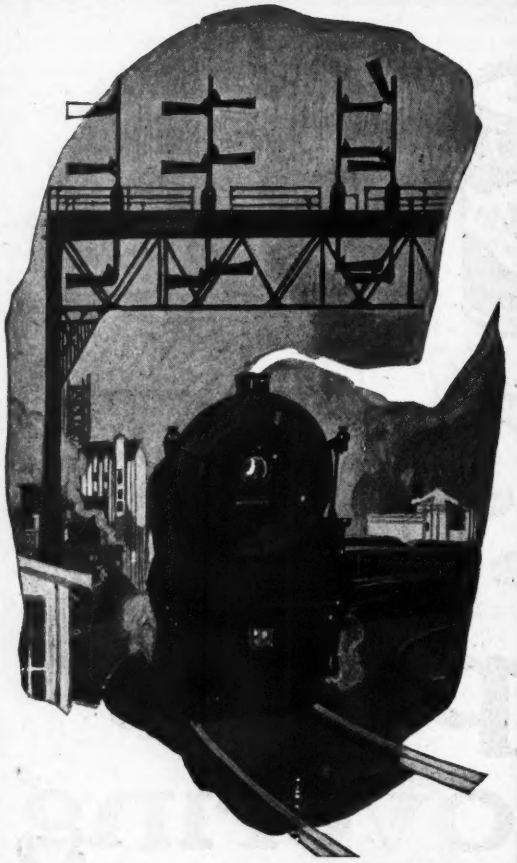
ECONOMICAL—Makes paint go farther and last longer. Retards chalking, reduces fading tendencies, produces a smooth, hard film that dust and dirt will not adhere to and that will not crack or peel.

WORKABLE—Breaks down without effort, mixes quickly with other paint pastes, applies easily.

HARMLESS—Absolutely safe for painters to use under all conditions.

MAINTENANCE OFFICIALS: For prices and further information write the Master Painters Supply Company, Inc., 160 Front Street, New York, licensed manufacturers of Mapaz.

New Jersey Zinc THE NEW JERSEY ZINC COMPANY New Jersey Zinc



SAFETY

to everybody concerned

Diamond Fibre and dependable block joint insulation travel hand in hand. Write it in your specifications and everybody is safe.

Diamond Fibre serves faithfully because it is a tough, strong, almost indestructible insulation made by practical men to meet practical railroad conditions. "Old Timers" depend upon it because it more than meets standard specifications.

For more exacting work—where extreme waterproof and extremely high electrical qualities are essential—use Condensite Celoron.

Diamond-F

Write today for a sample of Diamond Fibre and Condensite Celoron. Both are materials about which every practical railroad man should be fully informed.

Diamond State Fibre Company

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Branch Factories and Warehouses:
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IN THE WOOD

there is strength, rigidity and neat appearance. IMPROVED Q. G. FIR GUTTERS cost less than copper or best tin and last two or three times as long.

Smoke and cinder deposits do not eat into Douglas Fir.

See Maintenance Cyclopedia

E. M. LONG & SONS
CADIZ, OHIO

TRADE IMPROVED MARK

O. G. FIR GUTTERS

The V. G. Portable Flood Light

5,000 C. P. — 10 Hours — 25 Cents

The V. G. Flood Light

FEATURES:

Carbide and water in entirely separate compartments.

Absolute safety.

No waste of carbide.

Will operate extension lights and cutting torches.

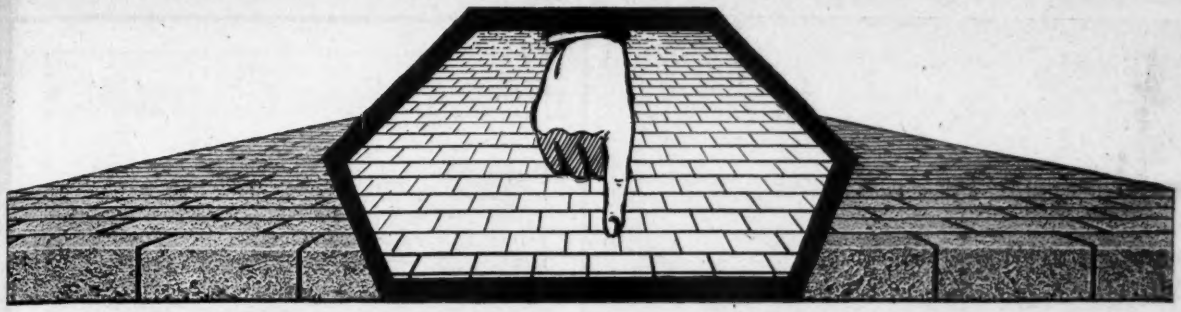
Not affected by weather.

Re-charging—easy and clean work.

A necessary equipment for all railroad divisions.

The Blake Mfg. Co.

Mansfield, Pa.



Drives—runways—platforms

These manufacturers with 55 conveniently located plants will be glad to serve you:

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Alton Brick Company
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Barr Clay Company
Streator, Ill.
Binghamton Brick Company
Binghamton, N. Y.
Cleveland Brick & Clay Company
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Pittsburgh, Pa.
Coffeyville Vitrified Brick & Tile Co.
Coffeyville, Kans.
Collinwood Shale Brick Company
Cleveland, Ohio
Corry Brick & Tile Company
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Georgia Vitrified Brick & Clay Co.
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Olean, N. Y.
Streator Clay Mfg. Company
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Thornton Fire Brick Company
Clarksburg, W. Va.
Thurber Brick Company
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Toronto Fire Clay Company
Toronto, Ohio.
Trinidad Brick & Tile Company
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Veedersburg Paver Company
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Western Shale Products Company
Fort Scott, Kans.
Westport Paving Brick Company
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FOR ECONOMY
VITRIFIED
Brick
PAVEMENTS

THE reasons for selecting vitrified brick pavements to surface railroad property total up impressively.

Long-lived—the rugged heat-toughened brick surface resists the most brutal usage.

Low-upkeep—repairs are few and far between—and simple when necessary.

Easily cleaned—reducing labor cost.

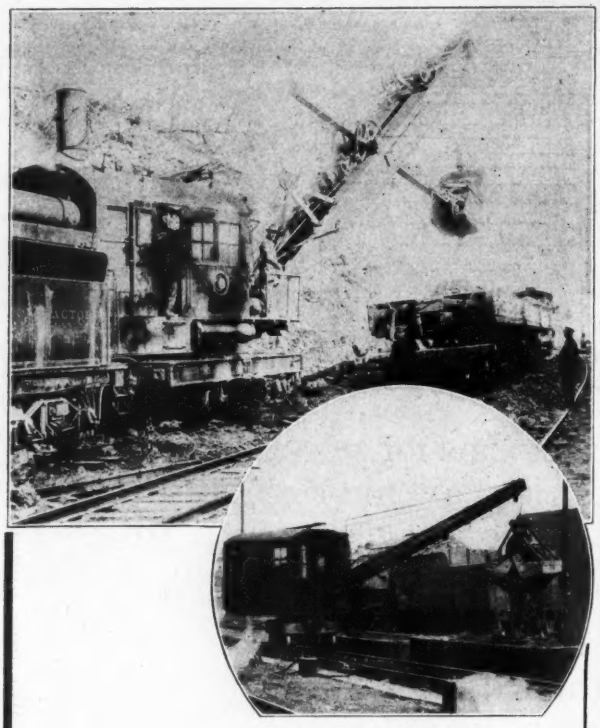
Non-absorbent—oil, grease or water cannot penetrate.

Non-skid—man, beast and truck wheel find the best traction.

High salvage—when a yard is changed or a platform moved, the brick comes up easily and goes back to work again unimpaired.

Each of these six counts in itself justifies the use of vitrified paving brick—the final and deciding factor is its reasonable cost.

NATIONAL PAVING BRICK MANUFACTURERS ASSOCIATION
ENGINEERS BUILDING - - - - CLEVELAND, OHIO



1873 TO 1923

50 Years

INDUSTRIAL CRANES

Of today are the development of 50 years' experience in design and construction of Locomotive Cranes.

Have you our Golden Anniversary Catalog?

INDUSTRIAL WORKS

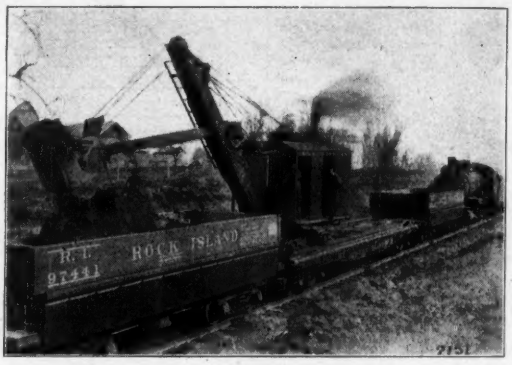
BAY CITY MICHIGAN

NEW YORK PHILADELPHIA
CHICAGO DETROIT

Sales Engineers in All Principal Cities

1873 BUILDERS OF CRANES FOR 50 YEARS 1923

OLDEST AND LARGEST MANUFACTURERS OF LOCOMOTIVE AND WRECKING CRANES IN THE COUNTRY.



OSGOOD ¾-yard H. D. Railroad Ditcher

WHY WORRY ABOUT MEN?

When an OSGOOD Railroad Ditcher will take their place and do the same work with less trouble. Can be used as Ditcher, Steam Shovel, Pile Driver, Crane, Clamshell or Dragline Outfit with either Railroad, Continuous Tread or Traction Mounting. Investigate this labor saver now.

¾ and 1 Cu. Yd. Capacities

Also 1½ to 6 Cu. Yd. Railroad Type
and ¾ - 1 - 1¼ Cu. Yd. Revolving Type
Steam Shovels

The OSGOOD Company

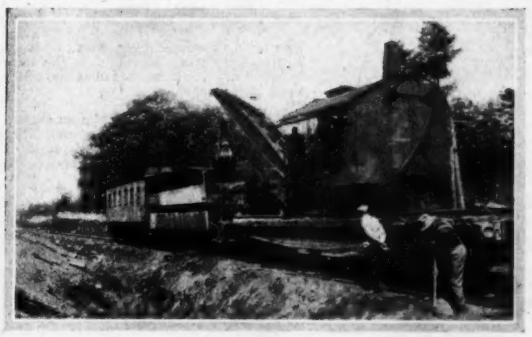
Marion, Ohio, U. S. A.

BLAW-KNOX
BLAW-KNOX PRODUCTS
—if you operate a Blaw-Knox Dreadnaught Bucket
Because the Dreadnaught is built for power—it's built for speed—rugged and husky and will rehandle and dig hard packed material with a minimum of expense for upkeep and repairs.
Hundreds of clamshell users are standardizing on Blaw-Knox Buckets.
MORE POWER TO YOU—if you fit your crane with a DREADNAUGHT
BLAW-KNOX COMPANY
639 Farmer's Bank Bldg., Pittsburgh, Pa.
New York Baltimore Birmingham
Chicago Detroit London, England

Blaw-Knox Dreadnaught Bucket digging on a sewer job.

BLAW-KNOX BUCKETS

Dump Your Load Beyond the Ballast



Ditching on the Maine Central Railroad. Loading Western 20-Yard Air Dump Cars With Clamshell Bucket. Note the Extension Floor or Apron.

Close Up View of Western Dump Car Apron, Showing How Dirt is Thrown Clear of the Ballast. From Photograph of Main Central Work.

Western

The Western Extension Floor or Apron can be attached to any Western Automatic Air Dump Car in use or included in your order for new cars. It solves the problem in ditching or bank-widening of any kind. After installing the "apron" cars the Maine Central dispensed with two men previously maintained on the dump.

"The cars will pay for themselves in two years," was the comment.

Send for specifications

WESTERN WHEELED SCRAPER COMPANY

Earth and Stone Handling Machinery AURORA, ILLINOIS

Greater Efficiency of Locomotives

depends on the quality of the water used in the locomotive boiler.

It is not possible to get the rated efficiency from any type of locomotive while using a water that causes scale deposits in the boiler.

Natural waters in many localities carry scale-making properties.

More than twenty-five American Railroads have entirely eliminated the troubles due to scale in their locomotive boilers by using the American Water Softener.

STATE YOUR WATER TROUBLES TO

AMERICAN WATER SOFTENER COMPANY

Fairhill P. O. Station PHILADELPHIA, PA.

Specialists for 20 years in railroad water purification

DO YOUR WELLS SILT UP?

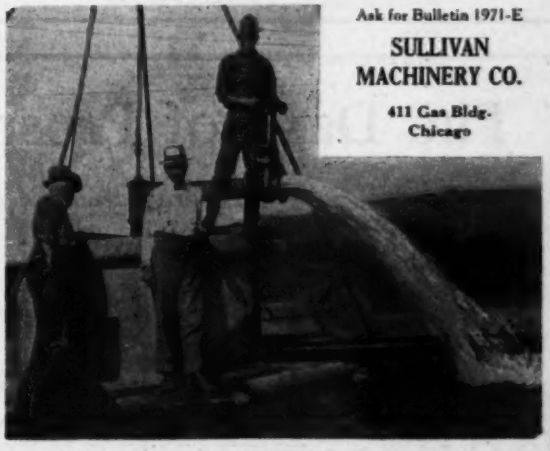
How much is your water supply curtailed by sand or mud accumulation? Do your pumps wear out or require frequent cleaning from this cause?

A SULLIVAN AIR LIFT

and properly applied "Back Blowing" will remove sand and mud troubles and permanently increase the flow from your wells.

This process may be repeated at any time, so that the screen and adjacent strata can be kept clear.

This cut shows a well in Utah being "back-blown." If you have a well pumping problem,—



Ask for Bulletin 1971-E

SULLIVAN MACHINERY CO.

411 Gas Bldg.
Chicago

How many of your water columns are knocked down every year?

What does the repairs and maintenance—not the result of ordinary use—cost you?

Avoid this annoyance, trouble and expense by using a

How lateral movement of spout prevents column being knocked down

POAGE Style "H" WATER COLUMN with FENNER DROP SPOUT

The three foot lateral range in the Fenner spout and the steel riser in the Poage Style H save the water column from being knocked down by the shifting of the tender.

The tender has to leave the track to knock this column down.

The flexible spout makes it unnecessary to spot the tender accurately. You save time by quick adjustment.

The five foot up and down range enables the water column to fill a tender of any height.

The open telescopic joint does not waste a drop of water. It banishes the usual winter time troubles. Ice does not collect upon it.

The valve permits the maximum amount of water to flow in the shortest time. There is a minimum of frictional resistance. It shuts the water off quick without water hammer.

Try the Poage Style H column. You will find that it has remarkable operating advantages.

Manufactured Exclusively By

The American Valve & Meter Co.

Cincinnati, Ohio

Specialists in the Design and Manufacture of

Standard—Insulated—Compromise Rail Joints

The Rail Joint Company, 61 Broadway, New York City

The Days of Prospecting Are Over

No longer do the prospector and the pack mule roam the hills in search of gold—wise men know where the gold lies and steady, concentrated effort brings it to the markets of the world.

Wise men these days are not prospecting for business and wise, buyers of railroad materials are watching the steady, consistent effort of the advertisers in

Railway Engineering and Maintenance

PUMPS

INDUSTRIAL–AGRICULTURAL–MUNICIPAL–RESIDENTIAL

A TYPE FOR EVERY SERVICE

Bulletins on request.

THE GOULDS MANUFACTURING COMPANY

SENECA FALLS, N. Y.

GOULDS

MURDOCK

"SAFETY FIRST" RAILWAY WATER SERVICE BOX

FOR

Coach Yard and Terminal

Positively Self-Closing
Either Full On or Completely Off

No Leakage No Waste
No Repairs No Freezing

Nothing to Stumble Over

Pat. Applied For

Type "B" with Westinghouse Coupler

Type "A" with Common Hose Coupling

ALSO

"GENUINE" MURDOCK SELF-CLOSING HYDRANTS

DRINKING FOUNTAINS
Fool-proof, for Shops, Stations, Offices

Write for Full Information

The MURDOCK MFG. & SUPPLY Co.
"THE ORIGINAL HYDRANT HOUSE"
CINCINNATI, OHIO.

Makers of Anti-Freezing Water Devices since 1853

"Does the work of an army of men"

THE JORDAN SPREADER-DITCHER IN ACTION

The Jordan Spreader-Ditcher
Tackling a Wet, Sticky Job.

THE JORDAN WILL KEEP THE ROAD-BED DRAINED DURING FALL RAINS. . . . JORDANIZED DITCHES MAKE RAILROADING SAFER.

Descriptive Literature Upon Request

O. F. JORDAN CO.

EAST CHICAGO, IND.

He's the only one who *doesn't* like

Texaco Crater Compound

and the junkman's grievance is over the fact that the use of Crater Compound cuts down his booty of worn gears and pinions—he doesn't get so many and he feels his loss.

Texaco Crater Compound increases the life of gears and pinions and saves wear and tear *and money* in a thousand different places on railroads.

Our nearest representative will welcome the opportunity of telling you about this unusual lubricant and wear-saver.

TEXACO

TEXACO

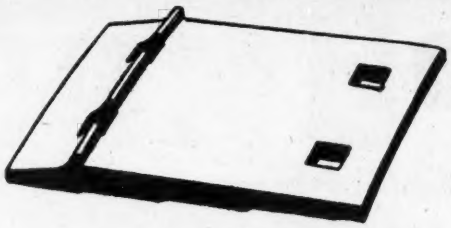
The Best Railway Lubricants and Service

THE TEXAS COMPANY, U. S. A.

Railway Sales Division

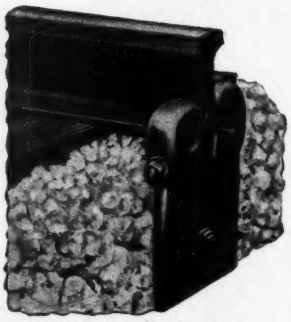
New York Chicago Houston Atlanta

Offices in principal cities



The Lundie Tie Plate

Will give rail and wheels longer life.
Will hold gauge and not injure a single fibre of the tie.
Will not rattle.



The Lundie Duplex Rail Anchor

Requires only one anchor per rail.

Will hold in both directions.

The Lundie Engineering Corporation

920 Broadway, New York

166 West Jackson Boulevard, Chicago

Classified Advertisements

Use this section when seeking a new man, a new position, or when buying or selling second-hand equipment.

CLASSIFIED ADVERTISEMENTS—$6 an inch, one inch deep by three inches wide, an insertion.

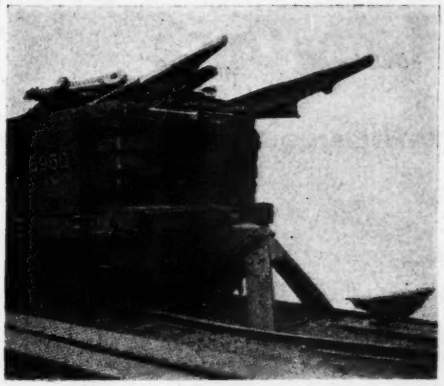
EMPLOYMENT ADVERTISEMENTS—5c a word a month. Minimum charge, $1.00. Remittance must accompany each order.

Railway Engineering and Maintenance

Classified Advertising Department

608 South Dearborn Street, Chicago

POSITION open for Draughtsman and Computer in Mexico. Railroad experience necessary. Salary $175, U.S.C. Apply Chief Engineer, S. P. de M. R. R. Company of Mexico, Empalme, Son., Mexico.



DURABLE

STOP

That is What

ELLIS AND DURABLE BUMPING POSTS

do. They stop cars at track ends. Positive, efficient, dependable. Backed by years of experience and service. Cheaper than putting cars back on the track and loss of time where posts are not used.

Send for Bulletins and Special Information.

The Mechanical Manufacturing Co.
Pershing Road and Loomis St.
CHICAGO, ILL.

ELLIS

Pipe Lines from B.B. Forman

B.B.Jr.:

I got the pictures you took last Sund on some of your new work. I didnt supose they could make that old rust streak look so much like a railroad. Some of them culvert jobs is as good as anybody could do and you got a right to be proud. No use talking-- them Massey concrete pipe sure makes culverts.

I noticed one thing you want to be careful about though. On the double line culvert marked Big Fork it looks to me like some of those big pipe wasnt set right. You know Massey Class B pipe is oval not round. and has to be set with the long diameter straight up and down like an egg standing on end. They even put a line on the top and bottom so anybody can see how it ought to be laid. If you havent started filling over that pipe youd better straighteb it up.

You may know a lot more about figuring stresses than I do but I know a lot of funny things happens in a new fill sometimes and the safe way to treat a Massey culvert is to put it in according to instructions. Then you know it will hold up the load.

As ever your Dad,

B.B.F.

MASSEY CONCRETE PRODUCTS CORPORATION, Peoples Gas Building, Chicago

Helping a Lame Duck

never did any permanent good—not even to the duck. Why not stop trying to maintain your quick-corroding black and wrought pipe and put in the everlasting

McWANE PRECALKED JOINT PIPE CAST IRON

Made in sizes 1¼ and 2 inches, and up to 6 inches, it is helping a dozen of America's greatest railroads today to end their troubles with rust and leakage in their small underground pipe lines. Ask for fact-booklet R.

McWane Cast Iron Pipe Company

Birmingham, Alabama

Write for name of jobber nearest you who stocks the "Martin."

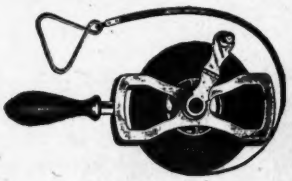
The Martin Portable Vise Stand and Pipe Bender

Here is a handy helper for you. It's a staunch, high-grade vise stand and pipe bender—and MORE. It's PORTABLE. Carry it knocked down to any place you want to use it. It weighs only 50 lbs. Can be set up in a jiffy.

You'll appreciate this handy tool. It's unequalled for cutting, threading and bending pipe and conduit. Stands rigid without fastening. Write for full details and price.

H. P. MARTIN & SONS
807 W. 12th St.
OWENSBORO, KY.

STURDY AND RELIABLE LUFKIN TAPES



In Patterns Best for Every R. R. Requirement—Surveying—Engineering—Construction—M. of W. Steel Tapes with ***Instantaneous*** **Readings and Nubian Finish. Babbitt Chain** (Chicago Style) **Tapes** with ½ gage mark and improved pattern reels.

Among our popular woven lines are the **"Metallic,"** and the low priced tapes for all common uses, the **Ass Skin,** and the **Universal No. 733R Linen Corded** with **First Three Feet Reinforced.**

STOCKED BY RAILWAY SUPPLY AND HARDWARE HOUSES.

Send for Catalogue **THE LUFKIN RULE CO.** **SAGINAW, MICH.** **New York Windsor, Ont.**

Q & C GUARD RAIL CLAMPS

STRENGTH *SAFETY* *ECONOMY*

The Q & C Universal Guard Rail Clamp provides a strong and safe means for absolutely securing the guard rail under heavy traffic. They can be easily and quickly applied without removing the guard rail.

The yoke is drop forged, high carbon, open hearth steel of the "T" beam construction. The wedge, adjustable filler blocks and shoe are made of high grade malleable iron and accurately fitted to the section of rail. Yokes are heat treated when specified.

The shelf on the wedge and the wide bearing surface of the shoe maintain the vertical alignment of the yoke.

As the yokes are interchangeable for all standard "T" section of rail, it is only necessary to order new malleable fittings when changing rail sections.

Prices Quoted Upon Request

THE Q & C COMPANY, 90 West Street, New York

CHICAGO SAN FRANCISCO ST. LOUIS

Rank & Goodell, ST. PAUL—Sherburne & Company, BOSTON—The General Supply Co. of Canada, Ltd., OTTAWA

ESTABLISHED 1882

THE WEIR FROG CO.

Track Work of Rail and
Manganese Steel Construction

Manufacturers of Balkwill Articulated Cast Manganese Crossings

CINCINNATI - - - OHIO

The Frog, Switch & Manufacturing
Carlisle Company Pennsylvania

Established 1881

FROG AND SWITCH DEPARTMENT
MANUFACTURERS OF
MANGANESE INSERT FROGS, CROSSINGS
AND SPLIT SWITCHES
SOLID MANGANESE FROGS AND
CROSSINGS
PLAIN FROGS, SWITCHES, CROSSINGS
SWITCH STANDS AND ACCESSORIES

MANGANESE STEEL DEPARTMENT
MANUFACTURERS OF
"INDIAN BRAND"
HIGH GRADE MANGANESE STEEL CASTINGS
FOR FROGS, SWITCHES AND CROSSINGS
JAW AND GYRATORY CRUSHERS
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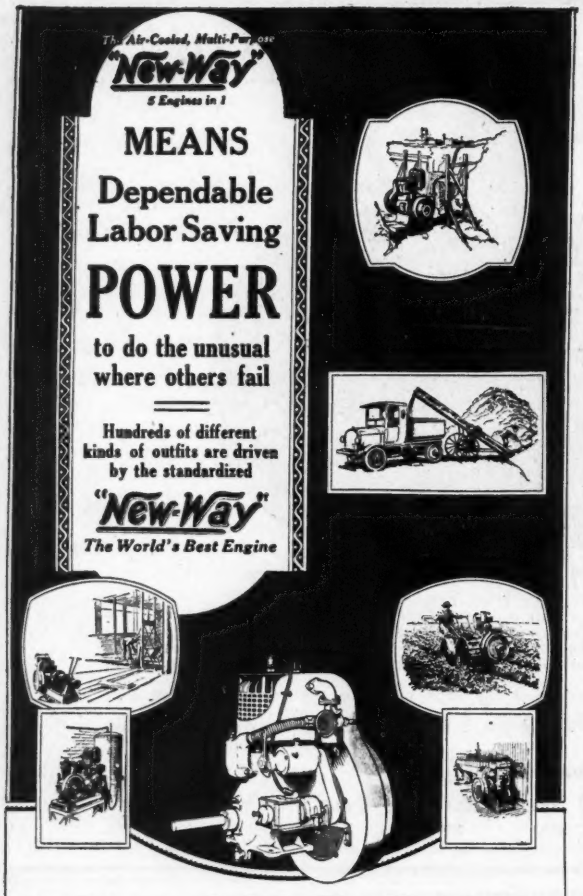

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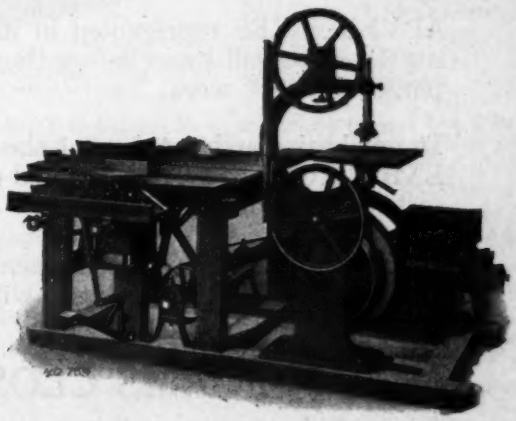

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THE OCTOBER ISSUE OF

Railway Engineering and Maintenance

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This advance issue will contain the reports and papers to be presented at the meeting and will be the GUIDE BOOK of the Convention.

This necessitates an advance run of 1,000 copies in addition to the regular net paid circulation of over 8,000.

After the Convention the Editorial forms will be re-opened and a sufficient number of pages added to cover the discussions and activities of the Convention before mailing to subscribers.

As the editorial pages will form the basis of all discussions on the floor of the Convention the ADVERTISING PAGES will be continually in the hands of the members and will be used as a source of reference in the discussions and in the outside exchange of views.

ADVERTISERS represented in its columns will thus have their special "talking points" at all times before those who are discussing the reports or special phases of track work.

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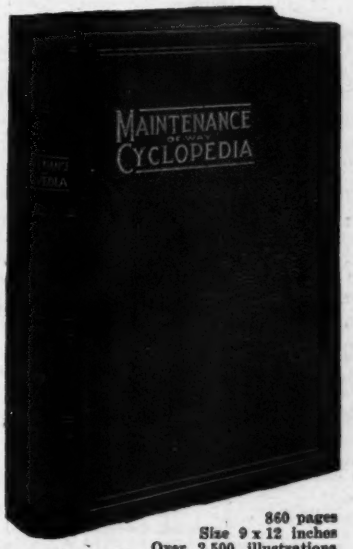

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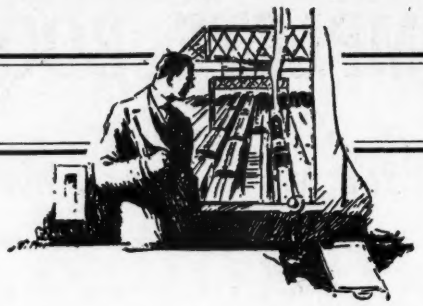

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Wheels (Hand and Motor Car).
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Mudge & Co.

Wire.
Armco Culvert & Flume Mfrs. Assn.

Wire Rope.
Fairbanks, Morse & Co.

Wood Preservative.
International Creosoting & Construction Co.

Woodworking Machinery.
American Saw Mill Machinery Co.

Zinc Chloride.
New Jersey Zinc Co.

ALPHABETICAL INDEX TO ADVERTISEMENTS

A
Air Reduction Sales Co..... 35
American Saw Mill Machinery Co. 31
American Valve and Meter Co..... 24
American Water Softener Co..... 23
American Well Works, The..... 13
Armco Culvert and Flume Mfrs. Assn. 17

B
Bethlehem Steel Co..... 31
Blake Mfg. Co., The..... 20
Blaw-Knox Co. 22

C
Chicago Bridge & Iron Works.... 4

D
Diamond State Fibre Co..... 20
Du Pont de Nemours Co., E. I.... 12

E
Eagle-Picher Lead Co., The..... 18

F
Fairmont Railway Motors, Inc..... 14
Fairbanks, Morse & Co..... 16
Frog, Switch & Mfg. Co., The..... 29

G
Goulds Manufacturing Co., The.... 25

H
Headley Good Roads Co..... 31

I
Industrial Works..... 22
Ingersoll-Rand Co..... 8
Inland Steel Co..... 10
International Creosoting and Construction Co..... 9

J
Jordan Co., O. F..... 25

K
Kilby Frog & Switch Co..... 30

L
Lundie Engineering Corp..... 26
Long & Sons, E. M..... 20
Lufkin Rule Co., The..... 28

M
McWane Cast Iron Pipe Co..... 28
Massey Concrete Products Corp.... 27
Martin & Sons, H. P..... 28
Mechanical Mfg Co..... 27
Mudge & Co..... 3
Murdock Mfg. & Supply Co., The.. 25

N
National Lock Washer Co., The.... 37
National Paving Brick Mfg. Assn.. 21
New Jersey Zinc Co., The..... 19
New Way Motor Co..... 30

O
Osgood Co., The..... 22

P
P. & M. Co..... 1

Q
Q & C Co., The..... 29

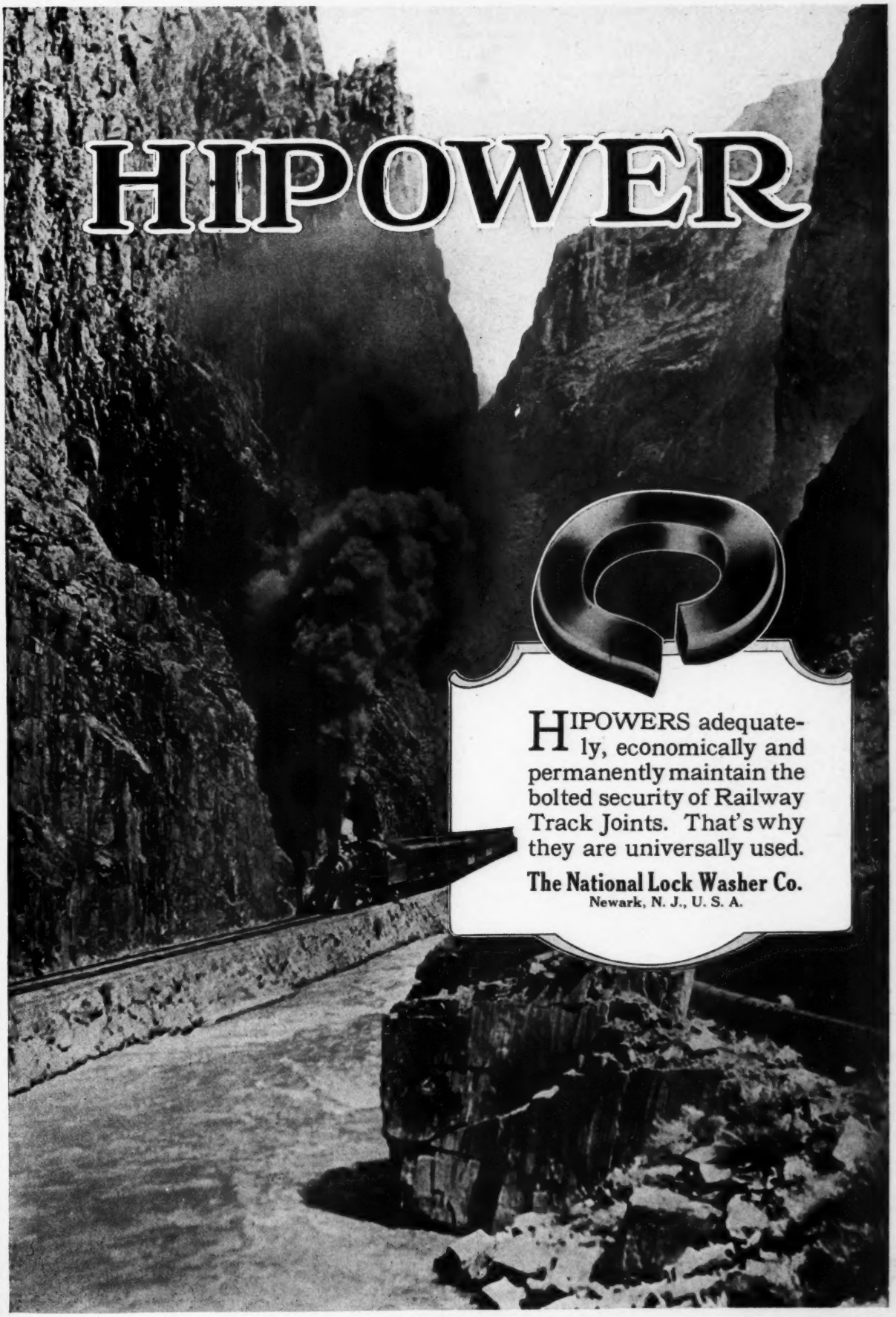
R
Rail Joint Co., The..... 24
Ramapo Ajax Corp..... 7
Reliance Mfg. Co., The..... 2
Robertson, H. H., Co..... 11

S
Selflock Nut and Bolt Co., Inc.... 15
Sullivan Machinery Co..... 23

T
Verona Tool Works..... 38

V
Verona Tool Works..... 36

W
Weir Frog Co., The..... 29
Western Wheeled Scraper Co..... 23
Wharton, Jr. & Co., Wm..... 30
Wood Shovel and Tool Co., The.... 6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HIPOWERS adequately, economically and permanently maintain the bolted security of Railway Track Joints. That's why they are universally used.
The National Lock Washer Co.
Newark, N. J., U. S. A.